Railway Maintenance Engineer

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Alphabetical Index to Advertisements, Page 5 Classified Index of Advertisers, Pages 5 and 6

ALPHABETICAL INDEX TO ADVERTISEMENTS

CLASSIFIED INDEX OF ADVERTISERS

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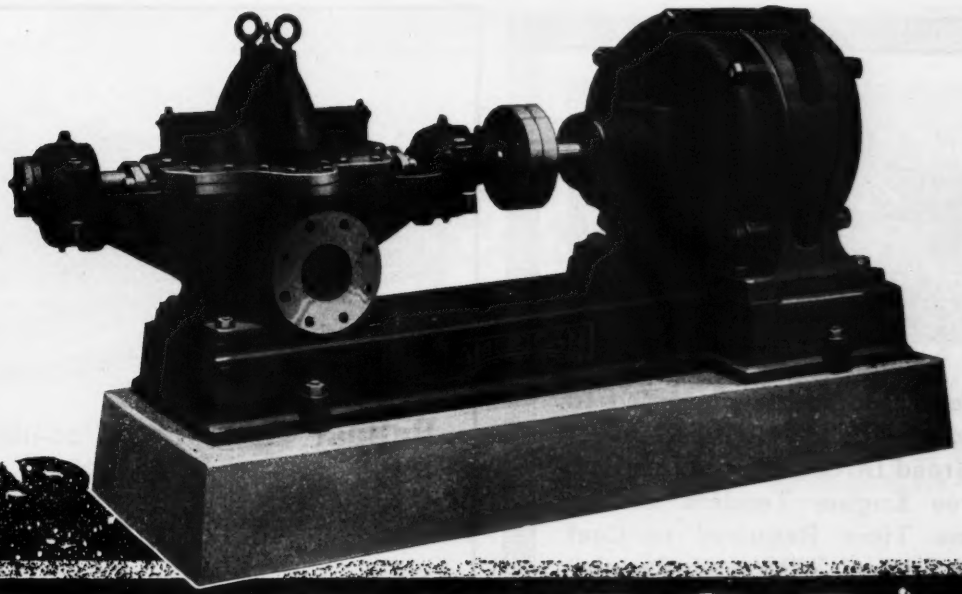

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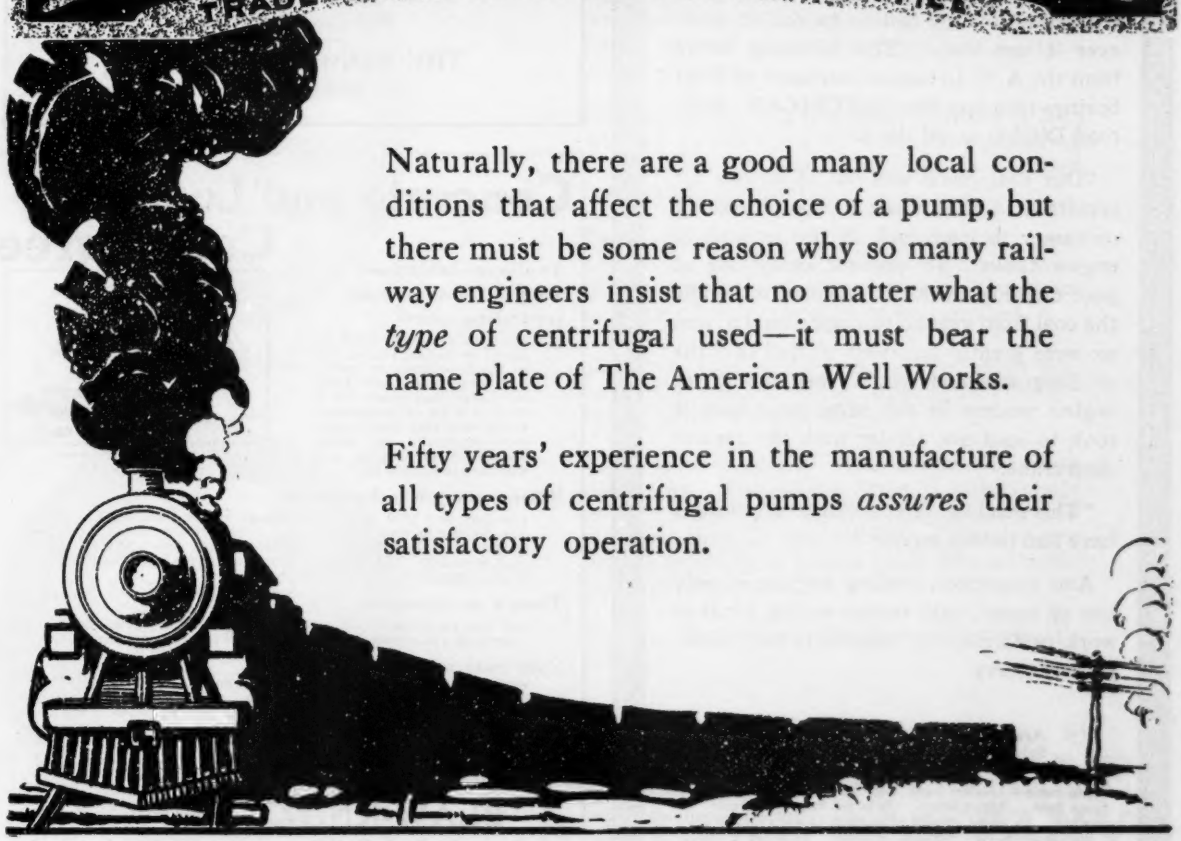

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State of New York } ss.
County of New York }

Before me, a notary public in and for the State and County aforesaid, personally appeared E. A. Simmons, who, having been duly sworn according to law, deposes and says that he is the President of the Simmons-Boardman Publishing Company, publisher of the *Railway Maintenance Engineer*, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

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Editor, Elmer T. Howson, Transportation Building, Chicago, Ill.

Managing Editor, Walter S. Lacher, Transportation Building, Chicago, Ill.

Business Manager, F. C. Koch, 233 Broadway, New York, N. Y.

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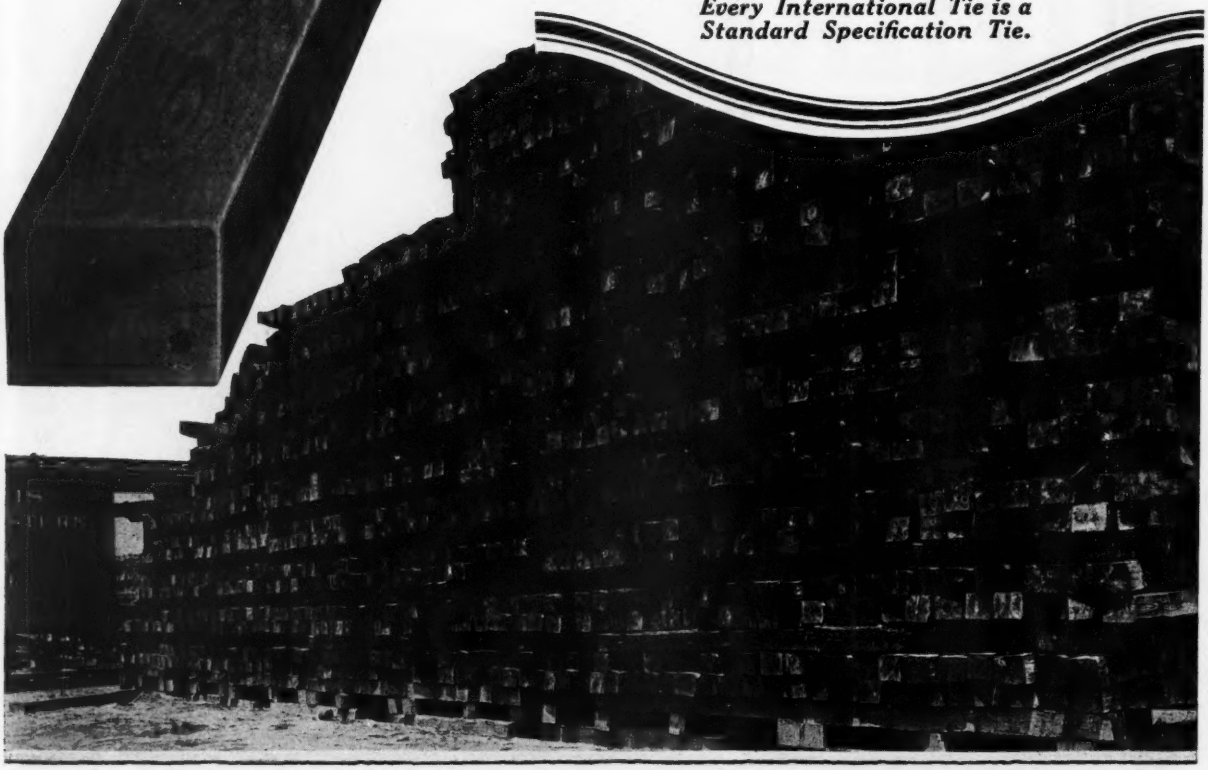

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Railway Maintenance Engineer

Vol. 18 November, 1922 Number 11

TABLE OF CONTENTS

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How misuse shortens the life of treated timber?
How to keep ice off tracks at track pans?
What a building inspector should look for?

Answers to these and other practical questions will be found elsewhere in this issue.

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(With which is incorporated the Engineering and Maintenance of Way Edition of the *Railway Age* and *Railway Engineering and Maintenance of Way*.)

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WE GUARANTEE, that of this issue 8,000 copies were printed; that of these 8,000 copies, 7,219 were mailed to regular paid subscribers, 57 were mailed to advertisers, 30 were mailed to employees and correspondents, and 694 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 79,900, an average of 7,282 copies a month.

Railway Maintenance Engineer is a member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulation (A. B. C.)

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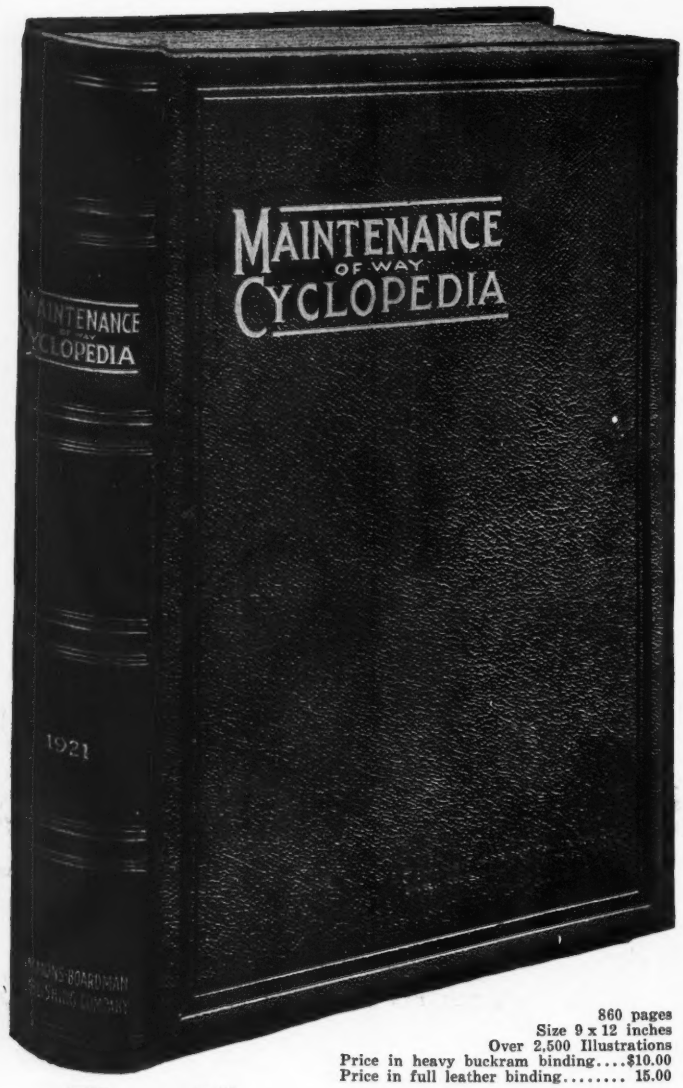

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—8—

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Railway Maintenance Engineer

Clean Out the Ditches

In the short time remaining before the arrival of winter, maintenance of way forces should give first attention to that work which will eliminate trouble when the cold weather comes. High in the list of such duties is the cleaning of ditches to permit the free flow of water and to reduce the danger of blockades and overflow. Supervisors and foremen can well afford to inspect all ditches carefully and to remove all accumulations of weeds, brush and other debris so that when the storms come they can give their undivided attention to their tracks and structures, knowing that their waterways are open and functioning properly. With present traffic prospects it is more than usually important that the forces should be able to concentrate their attention on the problem of keeping the line open when the storms arrive and thus reduce the possibilities of delays to traffic to the minimum. The old adage of a stitch in time applies here as elsewhere.

Make the Record Now

There are few details of engineering work which are accorded more unanimous endorsement in theory but are more generally ignored in practice than the recording and mapping of underground pipe lines and fixtures. The necessity for such records of the original installations and of all revisions or additions is self-evident. On most roads this need is reflected in general instructions, yet when the necessity arises for the uncovering of a line to repair a leak or to make some change, it is the common experience to find that the pipes are not where the records show that they ought to be. As a consequence it is necessary to "prospect" for them, frequently at the expenditure of considerable time and money. This condition arises principally from neglect to make a record *at the time the work is done*, this being left for some later time, with the result that it is forgotten until the need for it arises and by that time all information is lost. The only remedy for this condition is to insist that a job of this character is not finished until the records are completed and sent to the proper office for entry on the maps.

Learn the Facts in Advance

The report on pile foundations presented before the Bridge and Building convention placed emphasis on the necessity for accurate and reliable information concerning the subsoil conditions at the site of the structure. In too many cases the data are obtained with the sole instrument available—a surveyor's steel lining rod—and are recorded as a note reading something like the following: "A ½-in. rod driven to a depth of 28 in. supported 310 lb. without settlement." Such information, of course, is worth almost nothing and leaves the real facts to be ascertained when the excavation is being made in accordance with a design founded on the meager information at hand. What is then learned often leads to changes in the plans that may prove both expensive in time and money—indeed, they may cost many times the expense that could have been incurred in making a thorough study of the site in advance. To mention a single illustration—piles may have been ordered of inadequate or excessive lengths or they may even have been provided needlessly. For some classes of structures no elaborate investigation is warranted. For instance, a reinforced concrete box culvert which rarely requires pile foundation data and is not readily injured by even marked settlement calls for little study of the soil conditions. But for bridge piers, on the other hand, too much care can scarcely be exercised.

Pleasing Outlook for Roadmasters' Convention

The success which attended the convention of the American Railway Bridge and Building Association at Cincinnati the third week in October presages an equally successful meeting of the Roadmasters' Association at Cleveland on November 19-21. The attendance at Cincinnati exceeded that of any previous year except 1921, while the character of the reports presented established a new standard. This result was contrary to the expectations of some, who feared that the severe demands which have been made upon maintenance of way officers during recent weeks would be reflected in a reduced attendance and less thorough committee reports. Rather, this convention showed a realization on the part of these men of the necessity for their coming in contact with their associates and participating in the discussion of their common problems in order that they might conduct their work most efficiently. The work which these associations are doing is ample evidence of their value. No officer responsible for the maintenance of tracks who can possibly be spared from his division can afford to miss the Cleveland convention, the program for which has been planned to meet the problems of today. Supervisory officers can well afford to encourage the attendance of at least a part of their division engineers and roadmasters, for the expenditure in time and money will be repaid many times over in increased enthusiasm and efficiency.

Why Not More Attention to Spraying?

The spraying of paint with the aid of compressed air is no experiment. It enables one to apply coatings with economy in both time and labor, it is especially adapted to work in restricted places and—what is not generally appreciated—it is economical in the use of material. Nevertheless, the paint sprayer is not used in bridge and building painting to the extent that is warranted by the success being obtained on other structures. Perhaps the greatest obstacle is a lack of interest by the practical painter—the man who follows the trade because he derives pleasure from the wielding of the brush and the spreading of the film of color. When such men are interviewed concerning the sprayer, the reply is almost invariably, "I like to have my paint *brushed* in." But this is a trade prejudice not founded on either analysis or experience and is one of the difficulties in the way of a full development of spraying. Another drawback is the natural inaptitude which handicaps some in their use of machinery. Even with the motor car, the roads have trouble with the man who is so constituted that apparently he does not even know which way to turn a nut. Therefore, the procedure most likely to produce good results is to select for the

first use of the sprayer, the foreman who has manifested enough interest and skill with machinery to keep his motor car in the best condition. The next step is to make him understand that he must save the cost of the new machine by greater economy in painting. With these requirements fulfilled it will be possible to demonstrate the merits of the device, after which further progress will be easy.

THE PASSING OF THE GASOLINE ENGINE

CONSIDERING the country as a whole, it would be incorrect to say that the gasoline burning engine has fallen into disuse in railway water service. Many engines recently designed for gasoline are still giving good accounts of themselves and it is still the general practice to use such power where units of small size are required. It is also entirely probable that situations will continue to arise in water service where these engines will remain a preferred class of power. But with these qualifications, it may be stated with reasonable certainty that the familiar type of gasoline burning engine is rapidly becoming obsolete as a prime mover of consequence in water service. The evidences pointing to this are unmistakable. On the larger railroads power units which were initially gasoline burning have with few exceptions (and these principally where attention has not been given to the subject) either been made adaptable for the burning of heavier oils or replaced by power conforming more nearly to present practice. Except for the automobile type engine, which is a new development in itself as applied to railroads, new installations calling for internal combustion types of power are now made with engines designed for kerosene or fuel oils and manufacturers' lists devote little space proportionately to the type of engines recommended widely only a few years ago. Thus the familiar type of gasoline engine has practically become a thing of the past.

This transition constitutes a reminder that water service, no less than other departments, never reaches a degree of perfection that cannot be enlarged upon and that practice and equipment, however long in service and however securely established, are always susceptible to modifications in keeping with altered conditions or better practice. It is a reminder that there may be other practices and equipment now in use including perhaps even some most recently established that may be capable of further improvement. While it is a commendable thing, therefore, for the water supply officer to "think twice" before consenting to any alterations in the general order of things, it is very important that he should keep his mind free from that prejudice toward innovations in general that will prevent him from adopting those practices or forms of new equipment that really merit his interest and attention.

A CALL TO ACTION

Within the past few weeks the car supply has changed from a large surplus to a shortage of more than 150,000. Many industries are being forced to curtail operations, large numbers of men are working part time, the farmers are unable to dispose of their crops as rapidly as they desire and many localities are approaching the winter with the prospect of a fuel shortage; all because the demand for transportation is greater than the roads can meet. Every employee of the engineering and maintenance of way department in common with every other person employed in railway service is engaged in a public service. It is his public duty at this time to do everything within his power to expedite the movement of traffic and to increase the capacity of his road. He can assist in many ways. He can so maintain the tracks and structures under his supervision that derailments, slow orders, and other conditions contributing to delays to trains will be reduced to the minimum. He can so plan his work as to eliminate as far as possible the necessity for the use of cars and locomotives in company service and, where cars are necessary, he can load them to their capacity and unload them as quickly as possible. He serves his country best who contributes most to its welfare. Railway employees have a distinct opportunity for service at this time.

IN CHINA AND IN AMERICA

IN China there is such a surplus of labor and wages are so low that the use of mechanical equipment to replace men can seldom be justified. In America, however, these conditions do not prevail, yet the railways are almost as prodigal in the use of labor in the maintenance of their properties as in the Orient. This is surprising in view of the marked progress which the American roads have made in the reduction of their costs of operation and can only be explained by the fact that the officers of the engineering and maintenance of way department have not awakened fully as yet to the possibilities for economies in this direction. Many operations, such as the renewal of ties, are repeated millions of times in a season and thus lend themselves admirably to mechanical performance. Yet relatively few devices have been developed for these operations and those which have been perfected have met with such indifference on the part of railway officers that the introduction of the devices has been accomplished, if at all, only after a protracted and disheartening campaign by their promoters.

Those industries and the employees in those industries have prospered most in which mechanical equipment has supplanted manual labor to the largest extent. While marked progress has been made in the development of steam shovels, dump cars, concrete mixers and similar equipment for construction work, similar progress has not been made in maintenance operations. Yet these require the employment of nearly half a million men. In a paper read before the Western Society of Engineers of Chicago last spring, and abstracted in the May issue of the *Railway Maintenance Engineer*, R. H. Ford, assistant chief engineer of the Chicago, Rock Island & Pacific, estimated that the work now performed by approximately 360,000 of these men will some day be done entirely or in part by mechanical means to the great economy of the roads and the betterment of those men retained by reason of their work becoming highly skilled. Some progress is being made in this direction as is indicated by the increasing use of the motor car and the tie tamper, but the progress is not as rapid as its importance warrants. This development will come only when railway men themselves awaken to the fact that it is to their interest even more than to that of the manufacturers that such developments be fostered. No railway man can afford to assume an attitude of indifference to this work, for if his costs are to be lowered and the efficiency of his forces increased, he must give personal attention to the development of mechanical equipment. There are many devices which a manufacturer has neither the facilities nor the necessary experience to perfect. The pioneer work must be done largely or (in some cases) entirely by the railways. The function of a manufacturer is to make them.

ARE YOU RUINING GOOD TREATED WOOD?

THE treatment of a piece of timber to prevent decay may well be compared with the waterproofing of a bridge deck by the membrane process. In the case of the latter, the structure is given a covering of impervious material, but this covering is effective only if it is placed with sufficient care to insure the entire absence of any break in its continuity. If the membrane is broken or punctured in any way, the water will get through. In the preservation of timber, it is impregnated with a poisonous material which penetrates to various depths, but which, except in rare cases, does not come in contact with all of the wood present. Therefore, the treatment must be made effective by surrounding the untreated wood in the interior with a layer of treated wood that will be just as secure against any break or opening as the waterproofing membrane on the bridge deck. Any cut or break which destroys the continuity of the protective covering affords opportunities for the entrance of the spores or fruiting bodies of the various forms of plant life which feed on and destroy structural woods.

It matters not how much care was taken in selecting the preservative to insure material of high toxic properties and security against evaporation, nor how thoroughly the impregnation of the wood was carried out to secure a uniform penetration, nor how thoroughly sound the timber was before it was placed in the treating cylinder, the value of the treatment may be almost entirely destroyed by any carelessness in handling the wood which results in bruising, puncturing, cutting, notching or sawing and thus destroys the continuity of the protective coating.

The problem of avoiding this cutting of the lumber after it has been treated is a difficult one since it runs contrary to basic practices in carpentry as they have been developed and observed through the long years of history. In spite of the high degree of control which is now exercised in the design of the more complicated timber frame structures whereby the sizes of members, and the number, size and position of bolts and other connections are definitely specified, the prevailing practice is to leave the actual fitting of the members to the carpenter and one needs only to watch a skilled workman go through the operations of framing a hip rafter to realize the degree of skill which these men have developed.

But this practice must be changed if we are to make a success of timber preservation. All of the cutting, boring and otherwise fitting of the sticks must be done before the timber is placed in the retort and this means that either the structure must be framed and assembled according to the usual practice, after which all pieces are match marked and sent to the treating plant or else the drawings for the timber members must be detailed with the same completeness that is now practiced in the case of structural steel, so that each member may be cut to the desired shape before treatment without the complete assembly rquired according to the ordinary process of framing. Either practice is satisfactory in so far as it avoids any cutting of the timber after it is treated.

But even the most perfect arrangement for framing the timbers before treatment does not solve the entire problem. We are a nation of wood cutters and so firmly has the habit of indiscriminate hacking and cutting of timber been breed into the workmen that it seems almost impossible to get them over this objectionable practice. Men are in the habit of handling logs with the cant hook and of burying the blade of an axe in timber on the least provocation, and it is extremely difficult to make them understand that this must not be done to treated timber. But hard as this may be, it is necessary for those responsible for structures built of treated timber to overcome this practice if they are to obtain the full life of the structures built under their direction. There is one fact which a man may well bear definitely in mind and that is that any abuse of treated timber leaves its mark indelibly recorded on the structure so that it can be noted at any time so long as the timber remains in place.

NEW BOOKS

Publicity Methods for Engineers. 207 pages, 65 illustrations, 5½ in. by 7½ in. Bound in cloth. Published by the American Association of Engineers, Chicago.

This book is the amended and edited proceedings of the First National Conference on Public Information, held by the American Association of Engineers, and, in brief, is an outline or development of the principles of presenting information about engineers to the public. In addition to the discussion of the principles, considerable space has been given to the illustrating of how this presentation of engineering information has been carried out successfully. The contents include five chapters: (1) Some Reasons for Publicity; (2) The Right Conception of Publicity; (3) Ways and Means That Bring Publicity; (4) Getting News in the Newspapers; (5) The Publicity Man and What He Needs to Know; and an appendix which gives (1) Some Approximate Costs for Estimating and (2) A Brief Outline of a Working Plan.

The Welding Encyclopedia—Second Edition. By L. B. MacKenzie and H. S. Card, editor and associate editor, respectively, of the Welding Engineer. 6 in. by 9 in.; 388 pages. Bound in flexible imitation leather. Published by the Welding Engineer Publishing Company, 608 South Dearborn street, Chicago. Price $5.

This is a reference book on the entire subject of welding by the several autogenous processes. In conformity with the characteristics implied by the title, the treatment is primarily alphabetical, but subdivision into several sections serves to concentrate matter under a number of logical heads. Thus, following the first 150 pages devoted to welding in general there are individual sections on electric arc welding, electric resistance welding, oxy-acetylene welding and thermit welding, and separate chapters on the special methods applied in the welding of boilers, pipes, tanks and rail joints. Some 30 pages are also devoted to regulations and codes governing the conduct of welding operations, the shipment of gas tanks, etc. The last 88 pages are devoted to a catalog or advertising section identifying the manufacturers of devices and equipment applicable to the welding industry. This is indexed both as to firm names and as to materials and equipment. The book is devoted primarily to the methods and materials applicable to the art of welding and covers the subject in minute detail. Brief reference is made to the welding of frogs and switches, while the building up of manganese track work is given more extended space. The chapter on the welding of rail joints is directed primarily at street railway practice.

RAILROAD VALUATION PROGRESS—The railroad valuation work on which the Interstate Commerce Commission has been engaged during the past eight years is now rapidly coming to a close. Up to August 31 504 accounting section reports have been served, covering 134,272 miles, or, 54.14 per cent, of the inventoried main line mileage; 584 land section reports, covering 132,067 miles, or 53.25 per cent of the total, and 593 engineering section reports, covering 158,730 miles, or 68.03 per cent of the total. From now on the work will primarily be focused on the roads having annual revenues of $25,000,000 or over. It is expected that by the end of the fiscal year, June 30, 1923, underlying reports will have been issued on all except six of these roads.

Are There Possible Economies in the Use of Track Walkers?

A Discussion Outlining the Important Considerations as Well as the Actual Practices of Typical Roads

SOME DOUBT has been expressed of late by maintenance of way men and others regarding the need, as a general proposition, of assigning track walkers specifically for the purpose of patrolling the line. While the track walker is almost an institution on many roads, on others, the creation of the duties or a more elaborate expansion of the existing patrolling came about during the period of heavy traffic incident to the world war when considerably more attention was paid to moving freight than to maintaining track. There is little doubt that under such circumstances, a regular and frequent patrol of the track by a man specifically designated for that duty and charged with some measure of responsibility, was almost a necessity on many lines. Under the changed conditions now confronting the railroads, there seems to be a reasonable basis for the doubt that the cost of this service on a large number of roads is perhaps in excess of the value received from it. Every dollar is needed today and tomorrow to rehabilitate the track to where it more nearly meets the standards that modern traffic demands.

Compared with two years ago, the railroads have made a distinct improvement in the condition of their track, even in the face of heavy economies. If more savings in expenditures can be made through the elimination of further waste motion, still a greater gain can be made in future months. This raises logically the question, among others of course, of the track walker, since the cost of this service per mile of line per year becomes a substantial sum. When is a track walker needed? When can the duties be handled otherwise? And what are the influencing factors to be considered?

Primarily, the service of patrolling the track is one of insurance; in other words it is accident insurance and the wages paid for this service are comparable to the premiums paid on fire or any other insurance dealing with destructive hazards. Any one who carries insurance of one or more of the forms mentioned will know from experience that the more hazardous the risk the larger is the premium. The same applies to track walking, the greater the risk of accident the more a railroad can afford to pay for the protection of its line. Certainly none can find the slightest excuse for the non-use of track walkers where bad slides may occur at a moment's notice, where falling rocks are imminent, at certain classes of tunnels and bridges and on sections of dense traffic main lines where broken rails are common. Much of this is not new and no doubt has been taken into consideration by numerous officers, but in the end it all comes back to the insurance idea.

It is presumable to believe that track walking originated or was developed years ago as a protection against broken rails, washouts and perhaps other contingencies, broken rails being, however, perhaps the main reason. Since that time railroad construction and maintenance has progressed so far that what was a frequent hazard, has now been so overcome through higher standards and better workmanship as to be an infrequent occurrence. There are, of course, exceptions to that statement but in the main it is true for railroading generally. Better and heavier rail laid on better line and grade has reduced the percentage of broken rails of today as compared with those of 20 or 25 years ago. On the other hand heavier wheel loads, denser traffic, somewhat higher speeds, although the latter is debatable as an actuality, have tended to offset this gain to some extent and form a series of conditions that must and are taken into consideration when track walking is under discussion. At the same time due consideration must also be given to the work which the section forces are doing, the length of the sections, the amount of track which the forces get over daily, the extent to which the supervisors or roadmasters are out on the line and the general standard to which the line is maintained.

Strictly speaking, the question of track walkers and their use should be restricted to the greater part of the line which has no unusual or abnormal physical conditions, or in other words, to that part of the line affected only by the more controllable factors of maintenance standards, traffic density, etc. Under this cataloguing, the use of track walkers hinges on the determination of how often such track should be patrolled. Without doubt, the density of the traffic is the main determining factor and on roads having a large number of trains daily, one would naturally expect to find a more extensive form of inspection than on others. In actual practice this is the case today, but the methods in vogue on the individual roads vary widely. It would seem that on roads of very heavy traffic density the track should be inspected at least once a day and this proves to be the almost invariable rule and on some roads it is exceeded. Just where the particular justification lies for more than one inspection of the ordinary run of track in one daily eight or ten-hour period, is difficult to see. In the first place the standards of construction are of a much higher grade and any defects which may develop into a dangerous condition in the 24 hours following one inspection will, generally speaking,. be rare.

Naturally a distinction must be drawn in regard to one daily inspection. It is manifestly impossible for a track walker to inspect carefully a four-track line, for instance, in one trip over, but he can certainly do a thorough job on a single track line and even a fair one on double track. As a rule, sections on heavy traffic lines are comparatively short, so that even where each track of a multiple track line is given an individual inspection, less than the full day's time will be consumed in the majority of cases. Shall the remainder of the day then be given over to a repetition of the inspection or shall the time be consumed in doing odd jobs along the right

of way? Where a permanently selected track walker is used, these are, with exceptions, about the only choices and both are followed among the railroads today. Following either of these plans, the extra time of the track walker is used at what is very closely in one case, nonproductive labor, and in the other labor of doubtful economy.

Another point somewhat difficult to reconcile with modern railroading is the practice of continuous or two-time or three-time inspection of the same section during the 8-hr. period of the day after which the track is unattended for 16 hr. Part of this may be due, in some instances, to a preponderance of daylight traffic but in spite of that factor, the practice seems an unbalanced one. If more than one inspection is necessary it would seem better practice to split it into one day and one night inspection.

If the main reason for track walking is to have a daily or once-in-24 hr. inspection of the track, due advantage should be taken of the daily inspection of, at least, a part of the section by the section forces themselves, such as few roads do. In this way a regular assigned track walker is not required although an inspection is made daily, with the result that a maximum of productive and beneficial labor is obtained. One very heavy traffic road in the east follows this plan, having only a few regularly assigned track walkers on main line tracks, inspection being made by a capable man out of the gang, who walks over the part of the section not covered by the section foreman during each day's work.

So far this discussion has related chiefly to the multiple track roads which carry a very heavy traffic. The practices of these roads show a wide variation, with a majority using a regular once or more than once a day inspection of the track on both main line and important branches, by a specifically designated track walker. Other roads throughout the country show a similar wide variety of practices. At best it is exceedingly difficult to determine where the dividing line in traffic conditions is and thus when the expenditure for a regular track walker or for a regular daily inspection of the track is necessary and when it is not. A few roads and by no means poor ones either, find it unnecessary to maintain regular track walkers on their main lines or to even maintain a regular daily inspection. It seems probable that the extremes to which this could be carried out on the lightest traffic roads would be in the neighborhood of an inspection on every alternate day or maybe two or three times a week. Actually, even under such a system, the track would be gone over a greater amount on the average than such a schedule would imply. The lighter traffic roads usually have long sections averaging anywhere from 8 to 12 miles. A daily round trip on such a section is about all that can be expected in eight hours or even ten, although the use of a velocipede or motor car will speed up the inspection materially. In the latter case, some work can be done outside the regular inspection but not a very large amount. Even a one-way trip over such a section would consume proportionately greater time if made from end to end because of the human element involved. Roads of lighter traffic and long sections fall into a class of their own and proportionately they can save substantial sums by a careful consideration of the question involved.

Studying the question of track walking from various angles, there seems to be more or less reason for the belief that track walking may be carried out to an unnecessary degree, particularly on some of the lighter traffic roads. Since the study of the practices of various roads more or less typical of the entire country is usually of benefit, the *Railway Maintenance Engineer* has secured data from such roads and presents it here. Taken as a whole, the density of traffic of the roads in the east from which reports were received, is considerably greater than that of other sections and this fact is reflected in the information presented.

The Boston & Albany uses track walkers on every section of its road and patrols the entire section twice during the daylight hours. The duties of the track walkers are typical, being to examine thoroughly all tracks, bridges, culverts, pole lines, overhead crossings, embankments and cuts, etc. On his return, the track walker makes a report to the section foreman regarding the particular items which he has been unable to correct or to attend to himself. At high rock cuts or other cuts where trouble is encountered due to continual seepage of water, additional watchmen are maintained throughout the year. During most of the year, these men are on 24 hours a day in three shifts. Some attention has been given to the patrolling of all main line tracks night and day, but the expense has not seemed justifiable as a general proposition and it has, therefore, been confined to points of special risk such as mentioned.

On the Central Railroad of New Jersey track walking is carried out to various degrees, the method and the amount being determined largely by traffic conditions and the number of tracks. On main line sections of four or more tracks, track walkers make two round trips daily over the section while on two-track main line sections, one round trip is made daily. In the case of single track main lines, a much greater differentiation is made, depending on traffic conditions, the methods being as follows: (a) the track walker makes one round trip daily over the sections; (b) the track walker walks one way over the section and travels the other on a passenger train; (c) in some cases where the section tool house is at one end of the section and a member of the gang lives at the opposite end, the inspection is made by this man walking to where the gang is working. The portion of the section between the tool house and the point where the gang is working is inspected by the foreman when passing over it; (d) inspection is made twice a week by a track walker when the switch lamps are taken care of; (e) inspection is made twice weekly by the section foreman, using a motor car.

In yard sections, track walkers are on duty daily except Sunday, where there are important yards, otherwise no assignment is made. In all cases when track walkers do not use the entire time on inspection, they work with the gang. In addition to track inspection, the track walkers have numerous other duties such as the care of switch lamps, the cleaning and oiling of switches, the tightening and changing of bolts in joints and frogs, etc., the renewing of bond wires, the repairing of crossings and platforms, the relieving of crossing watchmen, the gathering of scrap and the policing of the right-of-way and numerous other small duties, according to local conditions.

The New York, New Haven & Hartford considers the track walkers next in importance to the section foreman and employs them on all sections of the road. Their duties are widespread and cover practically everything which it is possible for a man in this position to do. During violent storms the regular daily inspection is changed when conditions require it to a constant patrol of the track, day and night, by the section foreman and the track walkers. Another modification of the regular patrol occurs during extremes in weather, that is, during extremely hot or cold weather such additional trips are made by the track walker as are required in order to insure safe condition of the track under all circumstances.

Practice on the Eastern region of the Pennsylvania is

somewhat different from the general methods employed in that the track is patrolled twice a night. This road maintains regular watchmen on bridges, in certain classes of tunnels and in cuts subject to danger from rock or landslides in addition to the track watchmen on the main line and on such branch lines where there is considerable freight traffic. The track walkers, in patrolling the track twice a night, are expected to look out for broken rails, to see that all switches are set and locked for main track and that doors of loaded cars on outlying tracks are secured; to examine buildings and other property of the company in order to protect it from fire and damage and to keep a close watch generally on the entire property of the company located within their jurisdiction.

On the Lehigh Valley each division is patrolled according to the local conditions, although in general it is that road's practice to employ track walkers on practically every section and these men continue to make their rounds until their eight hours of service has expired. This service is maintained daily except that on Sundays it is curtailed to the extent that each track walker covers nearly two sections although this varies on the different divisions according to local conditions. Branch lines are patrolled in a like manner where it is felt that the traffic is heavy enough to justify it. Certain parts of the road are subject to mine settlements and here a regular 24-hr. service is maintained, the "cave" watchmen acting also as track walkers. The same is true in certain mountain sections. In general, track walkers on the Lehigh Valley make a constant patrol of the track and in addition, keep all track bolts tight, adjust rail anchors, re-drive spikes, examine and adjust frogs and switches, clean and care for switch lamps, pick up scrap and perform numerous other duties, such as relieving crossing gate watchmen, etc.

The New York Central and likewise the Philadelphia & Reading maintain a daily inspection of the track by a track walker selected by the track foreman from the gang. These men work in the gang and are the more efficient, experienced and reliable members of the forces. They report to and take instruction from the section foreman. Their duties are much the same as those which have already been outlined for other roads.

The Delaware, Lackawanna & Western does not generally employ regularly assigned track walkers on main line tracks, except at a few locations where the switch lamps, ordinarily cared for by the signalmen, are maintained by the roadway department. In this case, the lamp lighter acts also as a track walker. In locations where that road does not have regularly assigned track walkers, a laborer out of each section gang is delegated by the foreman to walk over that portion of the section not covered by the section foreman during each day's work.

On the Chicago & Alton, except on the more unimportant branches, the entire track is patrolled by a track walker every day, including Sunday. The duties of the track walker are similar to those of other roads and after the performance of the day's duties he reports each night to the section foreman on the general results of the inspection, the condition of the track and the places where the section gangs are needed when circumstances are such that more than one man is necessary to make some needed repair. Sometimes when the gangs are small, a quick inspection of the track is made by the track walker in company with the foreman or by the foreman alone by motor car, after which the track walker joins the section forces and works with them.

The Chesapeake & Ohio uses track walkers on main lines and important branch lines in addition to special watchmen at tunnels, etc. Some recent instructions sent out by L. B. Allen, superintendent maintenance of way, illustrates clearly the prevailing practice of this road. They are as follows:

> It is understood that track walkers will return to their forces and work with them after they have been over their track. The principal duty of the track walker is to go over the track, looking for broken rails, missing bolts, defective switches, and trouble of various kinds, repairing same if he can do so, and if not, notifying the foreman. In many instances the track walker performs other duties, such as caring for switch and signal lamps, tightening bolts, etc.
>
> It is questionable whether or not it is necessary on some of the side lines to have track walkers go over the track daily. This is a matter for local decision. It must be understood, however, that the track walker must perform a day's work and that after he has performed his duties as track walker he must return to his force and finish the day.

Out of 874 main and branch line sections on the Southern Pacific, 590 have assigned track walkers. These men are assigned to the heavy traffic main line sections, particularly in mountain territory as well as on many of the longer branch line sections. Their duties are to cover the entire section at least once a day, either on foot or on velocipede cars, examining the track for broken rails and other dangerous conditions. In general, as they cover their sections, the track walkers are required to attend to all the numerous small tasks along the track in order to obviate the necessity for moving a section gang out. As on other roads, special watchmen are assigned regularly at particularly hazardous locations.

The only places on the Chicago, Burlington & Quincy where track walkers are used to any extent are points where the track follows a river closely or where it is laid close to the base of a bluff where a possible slide might obstruct traffic. They are used at these places only during wet weather or during or after storms which might cause damage. All sections of track, however, are inspected at least once a day by the foreman or a competent man and are inspected after or during storms, day or night, whenever there is any liability of damage. On Sundays and holidays when regular section gangs are not working, it is the practice for the roadmaster or a competent foreman to inspect main line tracks from the rear end of a train, riding over a considerable territory. The regular daily inspection by each section gang is thus dispensed with. Branch lines are not inspected on Sundays, if no trains are run on that day.

The Cleveland, Cincinnati, Chicago & St. Louis does not employ track walkers generally, although it is the practice of that road to inspect all of its main track at least once in 24 hours. Regular watchmen are employed at points of special hazard, while under certain conditions in extreme winter weather track walkers are also used at night to protect against broken rails. Track walkers are also assigned to sections where there is any uncertainty as to safety during periods of extremely heavy rainfall.

Various conditions, such as an absence of rock cuts which are liable to cause trouble, a low record for broken rails, straight track, a wide right-of-way with absence from the danger of falling trees, have rendered the question of track walkers a matter of small interest to the Atlantic Coast Line. For this reason, they are not employed to any extent although the road has a rule that when storms occur the section foremen must get out their forces and patrol the track.

The Michigan Central and the Chicago & North Western are two other roads that do not employ track walkers generally, their use being confined chiefly to special points such as, for instance, the tunnel at Detroit, Mich., on the first named road and other locations where there are track conditions which require an additional inspection over what is furnished by the ordinary section forces.

Do What Is Right and Insist on the Same Treatment From Others

President Harahan Says That an Officer Cannot Succeed Unless He Is on Proper Terms with His Men

By Walter S. Lacher

IT IS A curious fact that young men in this country are very much inclined to choose other occupations than those in which their fathers were employed. But there are exceptions to every rule, for among the men who have made their mark in railway service will be found not a few whose fathers were railway officers before them. On some roads the enlisting of officers' sons is rather common; on others it is frowned upon because it leads so readily to charges of nepotism and partiality. The young man becomes the object of an envy that is too often intermingled with scorn engendered by the feeling that he holds his place by virtue of relationship rather than merit. It is not a comfortable position for any man, no matter how thoroughly he has demonstrated his right to recognition by hard and effective work. William J. Harahan, who was president of the Seaboard Air Line for six years and is now president of the Chesapeake & Ohio, can speak from first hand knowledge on this subject, because much of his railway training was obtained with roads on which his father, the late James T. Harahan, held important positions.

William J. Harahan
President, Chesapeake & Ohio

"One of the principal reasons why I left the Illinois Central in 1907 to become assistant to President Underwood of the Erie," he said, "was because I wanted to get away from the road of which my father was the president. On the other hand, I realize fully how much I owe to my father for the training and advice he gave me in the early years of my railway experience. He was not an easy man to work for; he was a most exacting taskmaster and I had to work very hard, not only to come up to his requirements, but, as I learned later, this was his method of insuring that I should measure up to the positions that were assigned to me. I found that the only way to get through with the work was to stay with it until it was finished, no matter how long it took."

"But it takes something more than hard work, doesn't it, to be a success as a railway officer?"

"Of course, work is only one of a number of essentials. Honesty is also important. By that I mean honesty of purpose. There is also interest. You have to be interested in your work to do it properly, and then, too, a great deal depends upon a man's capacity and brains. But, first of all, he must be industrious. He must do his best always."

That unceasing industry has been a rule with Mr. Harahan himself was brought out in a conversation with an old Illinois Central employee in Chicago.

"What I recall most distinctly about Mr. Harahan when he was here was the long hours he spent at his desk. It was a regular thing for him to stay in the office until 10 or 11 and he seemed to make no distinction as to Sundays and holidays. He also expected a lot from his subordinates; not that he was unreasonable, but a man simply had to 'hit the ball' if he wanted to get along with Mr. Harahan."

Mr. Harahan manifests a certain pride in the early start he made in his railway career.

"I might almost say that I learned to read out of a timetable," was the way he expressed it. "I commenced working as a call boy and messenger when I was about 13, but this only occupied my time outside of school hours. I got my first steady job when I was 17, after I had finished St. John's Academy at New Orleans."

"Did you have any definite idea then as to the branch of railroading you wanted to follow?" I asked.

"Yes, I wanted to get into transportation work. My father was then general superintendent of the Louisville & Nashville and had also served seven years as a roadmaster, so I had a natural leaning toward the course he had followed, but on his advice I entered an apprenticeship in the Louisville & Nashville shops at Louisville and stayed there for three years. I have learned since then that this was a valuable experience. It gave me a ground work in mechanical matters that has made it easy for me to keep informed on the progress in locomotive and car practice that has taken place since that time."

"Do you consider it essential to have an all around, varied experience?"

"No, perhaps it is not, but at the same time it is valu-

able. My intimate contact with the shop work gave me an insight into mechanical matters that has been a great help to me as an executive, and so it has been with the knowledge I got of maintenance and construction. On the other hand, when I was made chief engineer of the Illinois Central in 1901 and also in 1911, when I was vice-president and chief engineer of the Erie, I found the knowledge of operating matters which I had obtained while serving as trainmaster, assistant superintendent and superintendent, was of great value in making the decisions on the engineering problems that were brought to me. This was true to even a greater extent in my next position on the Illinois Central, that of assistant general manager handling all physical work, that is, maintenance, construction and equipment. Then as general manager in 1905 and later as vice-president in charge of operation, and vice-president in charge of traffic and construction, a detailed knowledge of the various branches of railway service was decidedly of advantage. You may think it is rather unusual to combine the direction of traffic and construction under one head, but you will see that it is perfectly logical when you consider that all construction is undertaken with the object of aiding traffic. This may not seem very much to the point, but I mention it to illustrate how interrelated the various branches of the service are."

"What was your training in maintenance of 'way work?"

"I took up engineering work," he replied, "when I was about 19 years old. I never attended an engineering school, but I got some engineering instruction from a private tutor at Louisville, who took a few students. He gave me some intensive training that supplemented my work in mathematics at St. John's. After eight years of miscellaneous experience I went to the Chesapeake & Ohio as engineer of maintenance of the Cincinnati division. Two years later, in 1890, I obtained a position on the Baltimore & Ohio Southwestern in direct charge of bridges and buildings under I. G. Rawn, who was then general superintendent of that road at Cincinnati. About the same time my father was made vice-president of the Illinois Central and in 1892 he offered me a position as roadmaster and trainmaster on the Freeport division, which I accepted, because I thought that there would be greater opportunities on a rapidly growing property like the Illinois Central."

"That was a rather unusual position."

"Yes, but it worked out very well and gave me my first direct experience in operating matters. Three years later I was made assistant superintendent and later superintendent. Of course, in my earlier years I had made it a point to learn all I could about transportation, so I was prepared for an operating position when the chance came to me. Every maintenance of way man should make up his mind whether he wants to follow operating or strive for higher engineering positions. If he wants to become an operating officer he should begin to study railway operations at once. To be a successful operating officer a man must learn to make quick decisions, because the nature of railway transportation is such that the operating officer is constantly required to make decisions on the spur of the moment. He *must* decide at once since trains cannot stand still awaiting decisions. This is a condition that does not often confront the engineering officer and I have known a great many engineers to fall down when placed in transportation positions because of their apparent inability to make the necessary change in mental process. It is, of course, particularly hard to do this when a man is new at the work, but a thoroughly trained operating man acquires a knack for making quick decisions almost automatically."

An ability to decide quickly is one of Mr. Harahan's outstanding characteristics and carries with it a desire for a prompt answer whenever he puts a question to a subordinate. Back of his demands, however, is a sense of justice that takes account of the circumstances under which the answers are given. Thus, one of his former assistants tells how he was once asked what it would cost to build a water station at a certain point.

"About $18,000," was the answer.

"How do you know it will cost that much," he demanded sharply.

"I don't know," was the reply, "without making a careful estimate, but I do know that it won't cost *over* $18,000."

"That's good enough," he answered, "I would have handled it in the same way."

It must be understood, of course, that the man involved in this case was one in whom Mr. Harahan had thorough confidence.

"I believe," he explained, "in giving a man as much authority as he can carry, after I am thoroughly satisfied of his reliability. Of course, an executive must always apply such checks as are necessary for good management and will insure him a thorough knowledge of what is going on."

"Are the problems of the railway officer different today from what they were in the earlier years of railway transportation?"

"Yes, in some respects. Today it is essential for the railway man to get the commercial viewpoint—to think of railway transportation as a business undertaking. Every railroad man should understand that there must be a proper relation between income and outgo and that this cannot be maintained unless it is watched closely from day to day. On the Chesapeake & Ohio we have an organization that does nothing but work up operating statistics, planning for the future rather than making post-mortems of the past. Based on information this department secures estimates of anticipated operating revenues by months for the year and with this as a guide we also make a distribution of required operating expenditures. Then from daily statements that are prepared by this staff I am able to see every day how the relation of revenues and expenses is being maintained. This does not mean that we aim to keep a fixed relation from month to month. Instead we distribute our expenses for maintenance of equipment and maintenance of way so as to carry on the work intensively in the most favorable months, but by keeping a close check we can tell in advance what changes to make in our plans so that we will come out all right at the end of the year.

"A proper attitude as regards public relations is also very important. Railway officers should make it a point to be fair and honest in their dealings with the public. Do what is right and insist on like treatment from others. It is the same with respect to employees. A foreman or a supervisor cannot succeed unless he is on proper terms with his men. A reputation for square dealing and an attitude of sympathy for their problems will be a great help in his relations with the men no matter how strong their allegiance to labor organizations."

A Cold Winter.—Dr. P. H. Dudley, consulting engineer, New York Central Lines, has issued his tenth annual forecast of winter weather conditions in which he states that present indications are that the winter of 1922-23 will be colder than the winter of 1921-22. He supports his conclusions with numerous statistics and charts showing the weather conditions at various points in the central states for the last 10 years. This forecast is issued to aid in preparing for winter operations.

Keeping Ice Away Around Track Pans

THE NEW YORK Central has been experimenting for some time with the use of steam lines to prevent the formation of ice around the running rails where track pans have been installed. Steam pipe lines have been laid along the top and near the ends of ties supporting track pans at both Rome, N. Y., and Tivoli. The results obtained have been excellent in that the rails, ties and pans have been kept clear of ice even during extended periods of below zero weather, while the cost has been about one-half that normally found necessary when hand labor is used.

The method has been in use for four years at Tivoli and for one year at Rome. It consists fundamentally of single lines of pipe along the ends of the ties under the track or, in other words, two lines of pipe for each track which is to be heated. Both 2-in. and 1½-in. sizes were tried out in the installations to determine the smallest size which would be effective. The results showed that while the 1½-in. pipe would accomplish the desired end, it did not free itself of condensation quickly enough. Hence 2-in. pipe was adopted and will be used exclusively in the future.

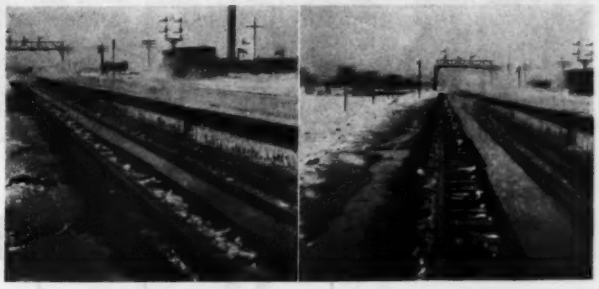
The pipe lines are laid for the full length of the track pan before being trapped to take care of the condensation. In these cases the full length was 2,000 ft. each on two tracks. Two methods of supporting the pipe were tried. In one case the pipe was supported slightly beyond the end of the tie and about on a level with the top by means of brackets; in the other, the pipe was placed directly on the top of the tie and held there by ⅜-in. by 2-in. bar iron bent into the proper shape. The

Conditions at Schnectady Without Steam Pipes

pipe placed across the top of the ties was found to be more effective and more easily maintained; neither, however, interferes with the surfacing of the tracks. Expansion joints are placed every 200 ft. and each 200 ft. section of pipe is anchored at its middle point.

A No. 20-gage, sheet steel shield was installed over and around the steam line giving an air space between the pipe and shield of about two inches. This was done to prevent as far as possible, the large volume of water splashed out by the engine scoops from coming in contact with the pipe. The operation of the traps indicates a considerable increase in condensation when engines are scooping water, even when the shield is in use. The shield is needed also to retard the flow of air across the pipe as this movement of air around the pipes is responsible for most of the condensation. It was found that a very small movement of air is sufficient to prevent the formation of ice over the ties and for a distance beyond.

The steam consumption of two pipes, each about 2,000 ft. long, which are required for one track, is equivalent to 90 to 100 boiler hp. or less than 200 hp. for the four lines as installed at Rome, with a prevailing air temperature much below zero. The actual coal consumption averaged 8 tons per 24 hr. more with the pipes in service than without them, locomotive type boilers being used to generate the steam. One extra fireman per 24 hr. was required. The total cost of operation and maintenance



The Pipes Installed at Rome Keep the Tracks Clear

(not including fixed charges on the investment) was very little over one-half the average annual expense of removing the ice formation with pick and shovel.

The accompanying photographs taken at Rome show how the steam pipes prevented almost completely the formation of ice after a heavy snowfall and several days of temperature from 10 to 20 deg. F. below zero. When the pick and shovel method is relied upon in the climate of this locality, the removal of the ice to a point a little below the top of rail is about all that can be accomplished. The photographs taken at Schenectady where steam pipes are not in use illustrate this. The difficulty of maintaining good track under troughs is well known and it must follow that track conditions will be much improved if the usual blanket of ice is prevented from forming during the winter months. The principal benefits which have been and can be derived from the use of steam pipes are economy, improved track conditions, and freedom from dependency upon labor. The last is not the least in importance for it is often very difficult to obtain and hold men for work during such severe weather conditions.

BLOCKED FLANGEWAY DERAILS TRAIN.—In a report issued by the Bureau of Safety of the Interstate Commerce Commission on the derailment of a passenger train on the Chicago & North Western near Waukesha, Wis., on August 30, the accident was attributed to an accumulation of rock and dirt in the flangeway at a highway crossing. At the time of the accident the train was running at a speed of approximately 20 miles per hour. According to a section foreman who saw the accident from a point about a thousand feet from the crossing, the cloud of dust arose from the derailment of a wheel on the forward engine truck. An examination of the engine and cars and of the track immediately following the accident afforded no clue as to its cause other than the blocking up of the flangeway. In support of this conclusion it was found that the space between the rails of the highway crossing was filled with finely crushed rock, which might have become packed near the rail. No flange marks were found on the surface of the rail.

A Convention Group.

Bridge and Building Association Meets at Cincinnati

Enthusiasm and Large Attendance Characterized the Thirty-second Meeting of This Association

THE thirty-second annual convention of the American Railway Bridge and Building Association, which was held at the Gibson Hotel, Cincinnati, Ohio, on October 17-19, inclusive, maintained the high standard in attendance and enthusiasm which has marked the development of this association since its organization in 1891. The attendance included 200 members and approximately the same number of guests.

Following the close of the convention a large number of the members spent Friday inspecting the Taylorsville dam, one of the principal features in the flood control work of the Miama Conservancy District, now nearing completion in the vicinity of Dayton, Ohio. The afternoon was spent in a trip through the plant of the National Cash Register Company in that city. Another instructive feature of the meeting in Cincinnati was a visit to the Cincinnati-Southern bridge over the Ohio river on Wednesday afternoon, the reconstruction of this structure having been completed early in the present year. This inspection was made more interesting to the members by reason of a talk given earlier in the sessions by F. W. Henrici, assistant engineer of construction, American Bridge Company, who described the problems encountered and methods pursued in the erection of the new superstructure. Prior to the inspection of this bridge the freight house of the Southern Railway was visited where the handling of l. c. l. freight by means of motor trucks and demountable bodies was observed. On Thursday afternoon the members were taken by special train to Steven's yard on the Chesapeake & Ohio, where a twin span turntable and other features of this terminal were studied. The annual dinner of the American Railway Bridge and Building Association and the Bridge and Building Supply Men's Association was held at the Hotel Gibson on Wednesday evening.

C. R. KNOWLES
President

Opening Exercises

The convention was called to order at 10 o'clock Tuesday morning by C. R. Knowles (superintendent of water service, I. C., Chicago), president. C. A. Lichty (inspector, purchasing department, C. & N. W., Chicago), secretary, offered prayer, after which the association was welcomed to Cincinnati by Froome Morris, vice-mayor of the city, and by James A. Reilly, president of the Chamber of Commerce. In his address Mr. Morris referred to Cincinnati's interest in the railways, as it is the owner of the Cincinnati-Southern, whose development he

Taken Tuesday Noon.

traced from its inception to its present position as one of the main arteries to the south and an important source of revenue to the city. Arthur Ridgway (assistant chief engineer, D. & R. G. W., Denver), first vice-president, responded for the association.

C. R. Knowles then reviewed the activities of the association during the past year, referring to the part which the members had taken in the settlement of the labor troubles. Fortunately for the association, its committee work was started early in the year and was well under way before the strike went into effect. As a result all of the committee reports were completed to the high standard characterizing the work of this association.

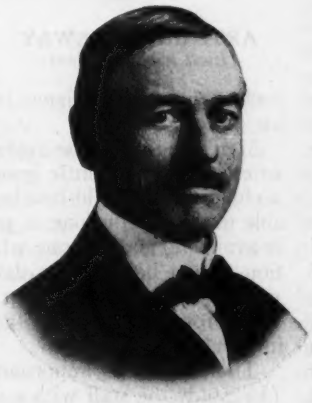
The report of the secretary-treasurer showed the total membership at the close of the last convention to have been 866, representing 127 railroads, in addition to which 75 applications have been received during the year.

The Fundamentals of Organization

By R. N. Begien,

General Manager, Western Lines, Baltimore & Ohio, Cincinnati, O.

MAXIMUM earnings and minimum expenses are impossible unless a railroad is carefully organized, and officers and men understand that deviation from the rules of proper procedure will not be tolerated. Every officer should understand clearly for what duties and results he is held responsible. He should not be excused from such responsibility on any pretext whatsoever. His superior should deal with him only, and he should never run around or ignore any officer, subordinate or superior. If responsibility is definitely fixed from top to bottom and a definite plan of action is made, an organization of ordinary men will accomplish far better results than the same number of brilliant men, each working hard to carry out his ideas.



C. A. LICHTY
Secretary

F. E. WEISE
Assistant Secretary

It is not possible to realize a high standard unless it is known what constitutes it. In a railroad organization some one has to fix the standard. Only one person can do it and he is the chief executive. It is important, therefore, that he should be a man who knows what a high standard is. If he selects a staff of men who are able to measure up to his ideals and who know what they are, he has made good progress.

Each man of the staff has his own special department, but he must conduct his department in such a way as to meet the standards of his chief. If an executive has selected his aids with a view to having them carry out his plans and ideas it may be necessary to go only into the question of standards, without consideration of methods of attainment. Instruction in method is generally necessary, however. Promotion generally comes to a man as soon as he has learned the importance of correct standards and organization, so that new men have to be educated constantly. Above all, a subordinate should never see that the standard of his chief has been lowered.

An accurate sense of justice is a valuable asset for any man. Without it a man is disqualified for an executive position. Some men have an excellent idea of justice when they are calm, but become unjust when they are disturbed in mind. A superior should never frighten a subordinate. If the chief makes no impression on his subordinate, then it is evident that the latter has but little regard for what he says. If his remarks do make an impression they will probably be passed on to subordinates.

If the chief is cross or excitable he usually says things he does not mean and leaves his subordinate with an uncertain feeling of what is required. He does not fill his man with a desire to accomplish much good, but he does often make him realize that his job hangs by a thread. He thus has a confused man who is frightened. Such a man will usually pass it on to his subordinates and it will go on down the line. The length of time that it

Three Railroad Groups: The Pere Marquette, the Northwestern and the Illinois Central

takes to disorganize a job will be in direct proportion to the number of times the "boss" explodes.

An organization of more than 10,000 men needs only about six steps from the top to the bottom. It will be conceded that one man is capable of supervising the actions of ten men. In addition he can educate them in the standards of his chief.

Look at this—

1	Chief officer
10	Vice chiefs
100	Heads of departments
1,000	Sub-heads
10,000	Bosses
100,000	Men
111,111	Total

Some railroads have more steps than shown; some have less. Thus the laborer on a section has only five steps to the presidency of a railroad. As there are only six grades from top to bottom, only four men have to interpret the words of the president before the man on the track is working according to the standards laid down by the president.

The selection of the subordinates in sequence is a most important matter. If a 100 per cent officer selects 100 per cent assistants the result is 100 per cent performance. If a 90 per cent general superintendent selects a 90 per cent superintendent, and he selects a 90 per cent division engineer, who employs a 90 per cent supervisor, who hires 90 per cent foremen and 90 per cent men, the result is a 53 per cent result.

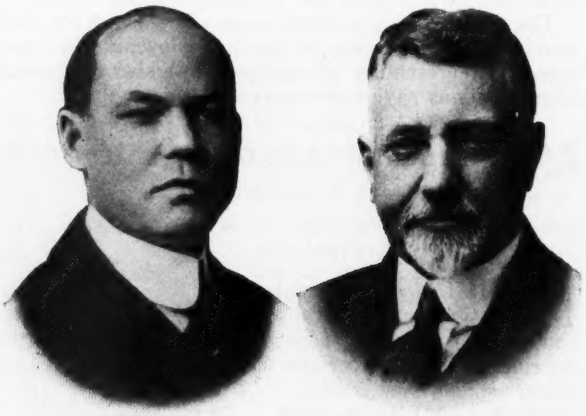
It should be remembered that the highest officer is the standard bearer and his men are rarely ever any bigger than he is. In other words, it is hardly possible for a 90 per cent officer to have a 100 per cent assistant for any length of time. They would probably change places if the relation was true, unless the chief raised his own standard to 100 per cent.

Men are largely what we expect them to be. It is perfectly evident to anyone who gives the matter thought, that if a subordinate feels that a mediocre performance is satisfactory to his chief, he has no incentive to produce more than a mediocre performance. Much can be gained by expecting a great deal of subordinates, as they will then make an effort to realize what is expected.

A railroad is a highly organized body. Unless care is taken in placing competent supervision in every part of the organization, the effect will be felt in other parts of the organization. An expensive and expert staff may evolve fine plans for economy, but they can not be carried out by a disorganized force. Proper organization will make expenses lower and earnings better at once, for it will then be possible to carry out a plan. It is important to remember that if a feasible plan cannot be carried out it is nearly always due to defective organization. For example, a bridge gang repairing a bridge may delay operation to the extent that the effects are felt over the entire railroad.

It is not unusual for a bridge gang or, in fact, for those who supervise bridge gangs, to feel that the railroad is operated very largely for the purpose of supporting the bridge gang, while we all know that the work of these gangs is entirely subordinate to the principal function of running a railroad—the handling of cars. From an economical standpoint it is always cheaper and better to delay the work of a bridge gang than to allow the bridge gang to delay the work of the railroad in serving the public.

It is not enough that an officer or a sub-officer is competent in the discharge of his own immediate duties. It is his chief duty to see to it that his force is competent, able and willing to do the things that are assigned to them to do in the best possible manner, and if he does not have



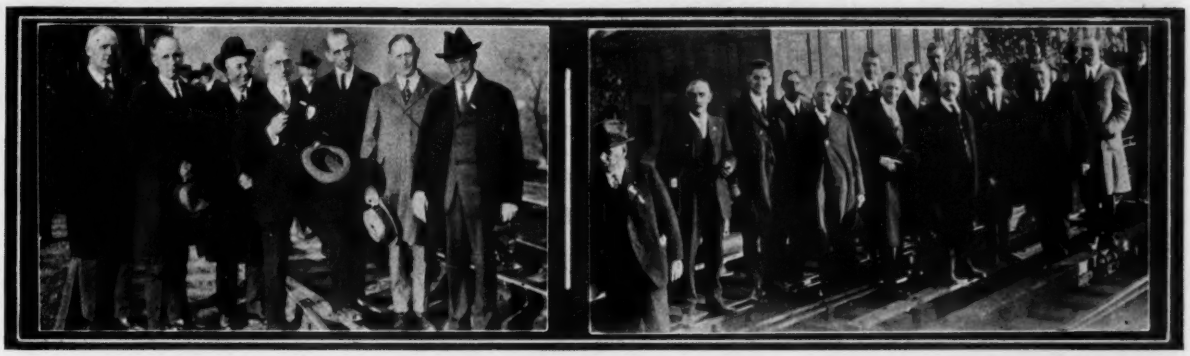
ARTHUR RIDGEWAY
First Vice-President

J. S. ROBINSON
Second Vice-President

such men he is negligent in the most important part of his duties.

Men should not be replaced indiscriminately, as it is often a fact that little good is accomplished by making a change. It should first be determined that a more suitable man than the one at present occupying the position is available, and the one who is now occupying the position cannot be made available by proper instruction. If men are made to feel that nothing but a high standard of performance will be satisfactory, they are bound to improve.

Therefore it is important to do the following things: (1) Study the staff with a view to knowing that they are performing their duties properly; (2) If they are not performing their duties properly ascertain if they can be



Some St. Paul Men and Others. The B. & O. Was Well Represented

instructed in such a way as to impove them; (3) If they are not suitable men for the positions which they are now occupying, and cannot be made to be suitable men, find out if there is any one who is suitable, or can be made suitable; (4) Impress subordinates with the fact that they should expect the same things of their subordinates as is expected of them; (5) Make subordinates feel responsible for the results in their departments. Encourage them in every possible way to take responsibility onto themselves. Do not spare praise in cases of successful administration, and in cases of failure try to find out what is the matter and help them work out a solution of the problem.

Every officer should understand it is not sufficient merely to state that the cause of some failure to perform a duty properly was that some of his subordinates did not carry out instructions. If the organization is a proper one excuses of this kind would gradually disappear.

In a divisional organization, the superintendent should

J. P. WOOD
Third Vice-President

C. W. WIEGLER
Fourth Vice-President

assign each member of his staff to definite duties and definite territories wherever possible. The object of such assignments is for the better delegation of work and for the fixing of specific responsibility.

The chief of each branch must feel that the results to be secured are strictly up to him. On the other hand, he should not be hampered in his work, and excepting that he should conform to certain standards which are laid down by his superior officers, he should be allowed to use his judgment, which is equivalent to asking him to exercise his ingenuity.

No officer should fall into the habit of dodging an issue. In his dealings with subordinates or others he should never speak of having referred a question at issue to anyone for a decision. To others his own judgment is the only one that should be asked for or should be given. If it should become necessary for him to ask for a ruling or advice, that should be a matter strictly between him and his superior officer.

It is important that new officers and employees be instructed in their duties before being allowed to fill a position. One naturally thinks that all new officers and employees are instructed in their duties prior to appointment, but it is too often the case that this is not a fact. It is true that some classes of employees are handed books of rules, and are examined upon them, but that does not constitute instructions in their duties. Good men often fail to fill positions on account of the fact that they are not instructed. Failure may occur on account of being overzealous, or backward to the point of laziness.

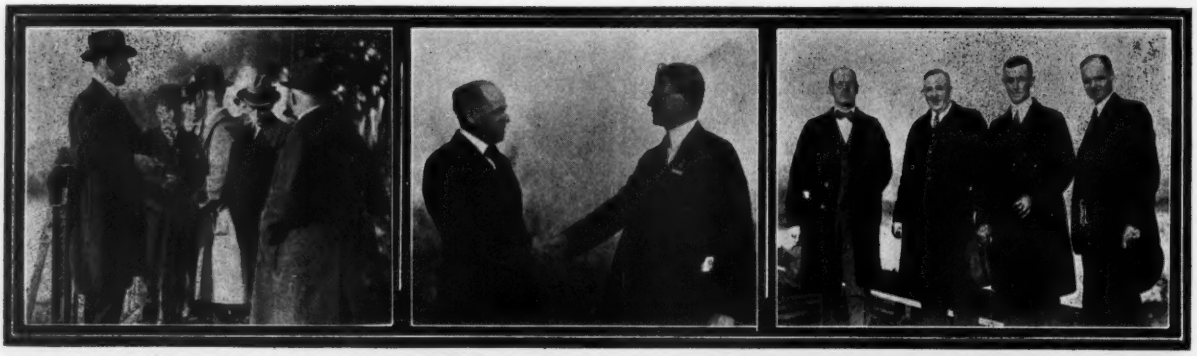
If a man is fit to be advanced at the start he generally is able to advance further and it is a serious reflection on his superiors if he fails. He must not be allowed to fail; it is the duty of his superior to train him and it should be impossible for men to be good men for a time and all of a sudden be discharged or demoted as unfit.

Notwithstanding the importance of organization, the personnel is, generally speaking, the last thing which should be disturbed. Where improvement is demanded it is better to mold the existing personnel into a proper organization and then see if the men can be brought up to the standard as individuals. Where there is disorganization it should be remembered that men of ability are often not able to work to any degree of efficiency on account of this. When the form of organization is improved the efficiency of the individual has a chance to assert itself.

It is necessary for every executive to form habits of thoroughness and concentration that will make it possible to compare values carefully. It is far easier to let things go along as they are than to organize and put into effect new ideas, but new ideas must be carried out. When an officer thoroughly realizes that betterments are possible in almost all operations he has reached a satisfactory starting point. It is certain that if his mind is made up that present conditions cannot be improved, he will waste a lot of time trying to prove that he is right. The first thing that an officer needs is the desire to accomplish things. A great personal desire to accomplish something is the strongest moving impulse that is known. It is greater than fear of punishment or hope of reward.

Some men are skillful in carrying out their own ideas, but have difficulty in getting into the proper frame of mind to carry out the ideas suggested by another. It is less difficult to get an idea carried out if by the power of suggestion a man may be led to believe that he himself originated it.

Discipline should be firm, but not hard. Adhere rigidly to the contract if there is one. In dealing with organized



Mr. Wood of the Southern Conducted the Party Over the Bridge. President Knowles Congratulated President-elect Ridgway. Three E. J. & E. Men with Mr. Henrici of the American Bridge Company on the Right

labor do not adopt an air of antagonism. Organized labor is here to stay, and there are features in its favor that may be and can be turned to the advantage of a railroad company, or any other company employing it. The wide influence of these organizations holds down complaints from individual employees and has standardized practice in the discipline of men that is not without benefit to the employer.

Rates of pay and working conditions may be the subject of controversy, but the local officer is chiefly concerned with the administration of the rules as laid down in the contract. In dealing with committees, courteous treatment and a disposition to hear their side of the case fairly will help the relation of officers and employees materially. It is not strange that the interpretation of the contract should be the subject of dissension. The contracts and their interpretations have grown in size and complexity. It should be remembered that thousands of lawyers make a living by telling citizens what their rights are under the Constitution of the United States and its various branches and interpretations. It could hardly be supposed that a few railroad men could draw up anything as complicated as a wage schedule without serious complications and differences of opinion.

The foregoing is largely fundamental; but it must be realized that until the fundamental conditions have been made correct it will not be possible to plan economies and carry them out successfully. Even then it should be remembered that large organizations absorb changes slowly. To get best results take up one thing at a time and correct the trouble in that. With each difficulty overcome other things will be benefited. Work slowly enough to observe fully the effect of innovations. Do not expect results too quickly.

It is possible that officers think a great deal of their own attitude toward the men of the rank and file and pay too little attention to what employees think of the officers and the company in general. It is certain that if a man likes his officers and is proud of the company for which he works, he will do much better work and form a better part of the whole organization than if he is dissatisfied and displeased with his "boss."

The rank and file know but little of the officers at the head of a large organization. They deal entirely with their foreman and it is generally the foreman, or his boss, who gives a man his idea of the company or concern he is working for. Since the man under discussion, in many instances, is the one who performs the manual work, for the purpose of getting results it is most important that he should be handled well and be in proper frame of mind.

The laboring man prizes most good working conditions, a steady job, a boss who knows how to handle men properly, and delivery of his pay envelope with regularity. In times of stress I have seen labor troubles of considerable size generated by failure of the paymaster to deliver the pay envelope on time, and it is worth the earnest thought of men in charge of organization to make a plan that will result in the men being paid with regularity.

Pile Driving and Pile Driving Records

THE committee included in its report and endorsed the definitions, specifications and principles of practice of the American Railway Engineering Association on timber piles, the driving of piles, and the stacking and driving of pre-molded concrete piles, as published in the manual of that association. The committee also presented a detailed review of more recent studies of formulas to determine the bearing power of piles. The following represents a summary of general considerations to be taken into account in any foundation problem involving the use of piles.

The engineer, in designing a structure, is able to forecast and provide for all the various stresses and loads to which the structure will be subject. Knowing then, what these forces are, his problem is to obtain a foundation that will be capable of resisting them. The soil should be explored to a sufficient depth to satisfy the engineer as to whether the ground alone will support the structure. If the investigation discloses that the ground alone will not sustain the structure he must then determine what kind of piles should be used, their length and number. If test piles are used they should be driven to a greater depth than it is intended to drive the regular piles. The driving should be observed and the safe load at various depths computed by a suitable formula.

If the earth is homogeneous it is only necessary that the piles be driven to such depths that the frictional resistance of the ground is greater than any load which will be placed upon the pile. It should be noted, however, that in most cases the ground to be penetrated is not homogeneous. In the case of a structure of great weight and extent the engineer should carefully consider the danger of stopping the piles in a hard stratum overlying a soft one, for the simultaneous loading of the great number of piles may cause the soft stratum to squeeze out and the structure to settle.

A test load may determine if individual piles or even small groups of piles will sustain a given weight over a given area, but it does not necessarily determine that when the piles receive their permanent load the stratum in which they stopped will not settle or break through into a softer one and cause it to be forced out in a horizontal difection. It appears that an exploration of the earth by borings is safer and more satisfactory than the driving of test piles, although a combination of the two methods

A Large Delegation from the Southern The Supply Men Were Smiling. A Group from the C. & O.

is ideal and to be recommended. The advantage of borings over the driving of test pile is that they can be carried to much greater depths and the exact soils encountered known. It also obviates the danger of stopping the piles in a hard stratum overlying a softer one as mentioned previously.

Very careful notes should be made of all earth explorations and the driving of test piles. It is well to keep samples of the soils obtained at the various depths of borings. These should be kept at least until the structure has been in use for some time and any danger of its settling past. The engineer will be repaid many times for the trouble and cost of making explorations, one advantage being an ability to order piles of such lengths that there will not be excessive cutoffs and waste.

The loads on the piles and their locations are determined by the design. Each pile must be driven until the required resistance is obtained, or until a given group of piles averages the required amount. The foreman or inspector must pass on the sufficiency of the driving and penetration to sustain the plan load. The most convenient method of supplementing the field man's judgment is by a suitable formula that will, from observed data, determine the bearing power of the pile. The factors entering into the resistance against the sinking of a pile are so many and so uncertain and depend on such a large variety of conditions that the development of a formula taking them all into consideration is not practical.

Pile Driving Records

The importance of making and filing complete and dependable notes of piles, pile driving, and soil explorations cannot be over-estimated. This has been brought home to the railroads in the work of preparing valuations of their properties for the Interstate Commerce Commission. These data will be found valuable in estimating and ordering material for emergency replacements as in the case of bridges destroyed by fire, washouts and wrecks. Other occasions for their use arise when structures are to be enlarged in extent or increased in height and when it must be determined whether additional piles will be needed and if so the number and lengths required. The results of soil explorations should not only be entered in the field books but also placed upon the piling plan for the information of the inspector and pile driver foreman.

The practice of the various railroads regarding pile driving records discloses a number of methods of recording and reporting data of pile driving operations. There is considerable opportunity for standardizing the important items in these records. The heading should contain reference to the location of the work on line or branch, date, contractor, pile driver number, and kind and weight of hammer. In case of the gravity drop steam hammer the make and number should be given, together with the number of strokes per minute, the height of fall and weight of entire hammer and striking part separately. If a double-acting steam hammer is used, it is necessary also to record the diameter of the piston.

In the body of the report some put in a date column so as to provide a continuous pile record and to give the opportunity to record the date each pile is driven. For piers and other foundations a sketch or pile plan will indicate the system of numbering. The kind of timber or concrete in the pile should be noted. In the case of timber piles the diameter of tip and butt should be given, and in the case of concrete, the date of manufacture and the name of the manufacturer. Next should be recorded the length of pile in the leads, the length below cut-off, and the distance from base of rail, top of pier or other reference to the cut-off.

The next group of data to be recorded is that regarding the penetration. It is well to record the total penetration and the amount of penetration in the soft and hard materials separately. Some roads record the rate of penetration per blow at the beginning, average, and final portion of the driving. To determine the bearing power of the pile it is essential to give the average drop of hammer for the last few blows and the average penetration in inches of the pile under these blows. With the steam hammer it is more convenient to record the number of blows used to secure the penetration of the last 6 in. or other designated distance, or to give the distance penetrated for the last 10 or 20 blows. In the case of the double-acting steam hammer it is essential to give the average pressure in the cylinder at the time the final penetration is observed. From these data it is possible to compute the safe load for each pile by using an appropriate formula.

A column for remarks should be provided in which can be placed notes regarding the batter of piles, broken piles, whether rings or shoes were placed on piles and other information that may be desirable. Many roads record the total number of blows for driving the pile. It is also desirable to give the original length of the pile used, where a pile is cut off before being put in the leads, provided the part cut off is wasted and not driven as another pile.

For the record of test piles it is necessary to give the rate of penetration for each foot of the driving and as much information as is possible regarding the kind of soil, along with the data of ordinary driving, as given above. It is especially important to get the complete record very accurately on the driving of test piles. The record of soil explorations by borings should show the location of the test and the distance from base of rail or other definite reference point to each kind of soil. Note should be made of the compactness and moisture content of the soils encountered.

One of the Most Interesting Features of the Convention Was the Inspection of the New Cincinnati-Southern Bridge

It is well within the province of this report to urge the making of clear and definite specifications for pile driving contracts and reasonable inspection during the progress of the work. Some engineers have subjected themselves to no little criticism in the past for loosely drawn pile driving specifications. The common requirement that the piles be driven to "practical refusal" is deplored. The use of this term has been responsible for the partial or complete destroying of many piles by overdriving.

In the matter of inspection, it is well known that the job of inspector is often sought by men of poor judgment and little experience, looking for easy work. The permanent engineering organization of a railroad should contain enough experienced inspectors to handle the ordinary volume of inspection work of the department. For the extraordinarily large jobs this force can be increased by hiring or by recruiting other men employed by the railroad whose experience peculiarly fits them for the particular work in hand.

It is a good practice to let pile driving inspection be part of the training of the young graduate engineer working his way up to the more responsible positions. However, the engineer in responsible charge of the work should determine from his own observation of the pile driving whether the records being obtained by his inspectors are accurate and consistent.

Committee: F. C. Baluss (D. M. & N.), chairman; A. M. Swenson (Soo); L. B. Alexander (M. C.); L. M. Blake (B. & M.); N. C. Ailes (D. & H.); A. C. Copland (C. & O.); H. Favreau (G. T.); T. N. Heron (A. & V.); K. Peabody (N. Y. C.) and G. A. Rodman (N. Y. N. H. & H.).

Discussion of Report on Pile Driving Records

In presenting the report F. C. Baluss, chairman, emphasized the necessity for the recording of complete information regarding each pile driven, particularly under important buildings and other large structures, in order to have the information necessary to determine the causes of such failures as may occur. J. P. Wood (P. M.) supported this view because of his fear that laxity in the preparation of such records on small structures would extend onto larger ones. In his opinion, a foreman or inspector could keep all of the records necessary in addition to his regular duties. G. W. Rear (S. P.) opposed this practice, contending that this work was sufficiently voluminous to require the full time of a man. Where conditions are fairly uniform he contended that a foreman should not be burdened with a repetition of this detail, but should keep the records of only a selected number of piles. J. S. Robinson (C. & N. W.) advocated the use of test borings rather than soundings, referring to failures which he had witnessed, due to inaccurate information derived from the soundings. F. E. Weise (C. M. & St. P.) referred to the troubles which the railways have experienced in valuation work, owing to the incomplete data which they possessed regarding the piles in their structures. On his road a simple report has been devised which places little additional burden on the foreman in collecting the most important information.

Building Inspection and Records

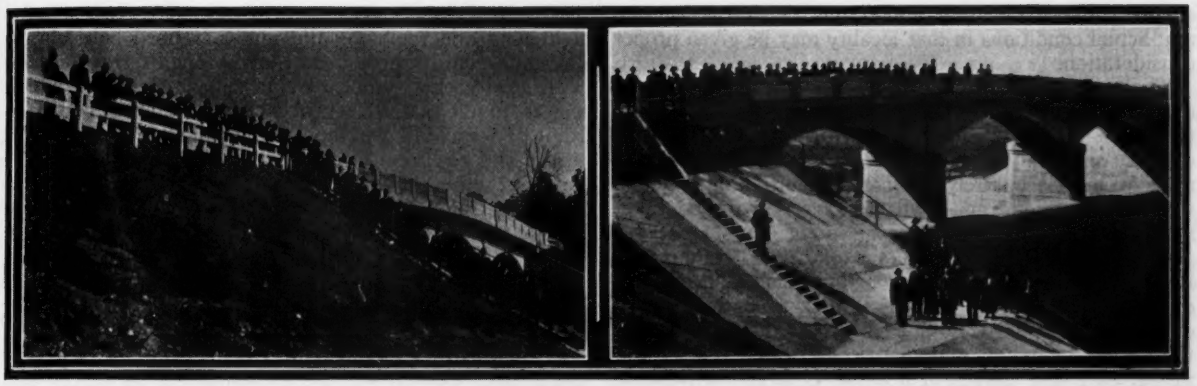
THERE is no class of railroad structures that is more varied in design, construction and use than buildings. Therefore to perform his duties properly a building inspector must have a thorough knowledge of the strength and life of materials in addition to a broad experience in building construction, which implies an ability to read and interpret plans and specifications readily.

The Inspection of Building Construction

The inspection of new buildings during construction carries with it important responsibilities, because the railway depends upon the inspector to see that it is getting the kind of a structure, both as regards materials and workmanship, that it is paying for. It is quite common for railways to provide standard plans for their smaller buildings. The larger buildings are designed individually to suit their location and use, and detailed plans and specifications are prepared by the engineering department. It is with the construction of such buildings that the building inspector is more directly concerned. Before the work is begun he should familiarize himself thoroughly with the plans, specifications and bills of material. From the time the work begins until its completion he should visit the job frequently enough to know that the proper materials are delivered, inspecting carefully their quality and fitness for the place and also watching the workmanship as the work progresses to make sure that details conform to the plans and specifications.

When the building is completed, the original plans and specifications, corrected to agree with any modifications that may have been made, form the office record of the structure. Changes on plans and specifications are usually entered on the originals in inks of different colors so as to be noted easily. It is customary for the inspector to make a weekly report, usually by letter, advising of the progress made on each portion of the building and calling special attention to unusual items.

The amount of inspection required on a new building depends somewhat on the nature of the structure and the reliability of the contractor. As a rule it is not necessary for an inspector to be on the ground continuously. He should aim to visit the job at unexpected times and make it a point to be present when work is being done that will be hidden from view in the completed structure.



On Friday the Convention Party Inspected the Engineering Works of the Miami Conservatory District Near Dayton, Ohio

Roofing is one of the materials that needs to be inspected and tested carefully. First the material is tested as to quality and then the laying is watched carefully to see that the material is properly applied and that it is not damaged in handling.

Inspection of Existing Buildings

It is customary on most railroads to make an annual inspection of all buildings and supplement this with intermediate inspections of such buildings as seem to require it because of their use or condition. On northern roads the annual inspection is usually made in the spring of the year, and the inspection notes are used as the basis for a work sheet for repairs and renewals to be made during the summer season. It is desirable to keep a book record for building inspection so that the inspector will have the benefit of the previous record. He should note on this the repairs made since the previous inspection. In many cases minor repairs are not recorded but only such as tend to improve the service life of the building.

Floors that carry heavy loads should receive special attention. Such buildings should be placarded, showing the allowable loadings, and as they grow older the loading should be checked from time to time in order that the allowable loading may be decreased or the floor strengthened as it grows weaker. Most cities have ordinances governing this matter.

There are buildings that have tracks in or beside them, such as shops, engine houses, freight houses, elevators, etc., in which sufficient clearance cannot be provided to permit men to ride on the tops or sides of cars. In many cases warning signs or signals are installed and the inspector should see that they are in place and condition.

The roof of a building should be given careful attention by the inspector. Roofing put on by contract is usually covered by a 10-year guarantee and the contractor should be advised promptly of defects that develop during the guarantee period. A roof may be damaged by circumstances for which the contractor cannot be held, as by brick from a falling chimney, workmen walking over it when making other building repairs, etc. Such items should be made a matter of record and reported.

It is desirable that a record be kept of the painting of a building, both inside and out, in order to determine the brands of paint that give the best service. The inspector's periodical report should show the condition of the paint, his recommendation for repairing, and his comments on the paint last used. The location has much to do with the life of paint on the exterior of the building. If gutters and downspouts are not made from good materials they deteriorate very rapidly and need close watching. Defects should be repaired promptly. Snow and ice cause much damage to them on northern roads.

As a rule, inspections for fire risks are handled by another department but the building inspector should co-operate and call attention to conditions that are dangerous. Risks due to adjacent buildings should also be given consideration. The careful inspection of flues and chimneys should be made early in the fall so that all necessary repairs can be made before fires are needed. Buildings such as laundries, lunch rooms, etc., that have fires every day should be inspected several times a year.

Special inspections should be made by an electrician to see that the requirements of the electric code are complied with and the regular building inspector should co-operate with him by calling attention to conditions that are doubtful.

Committee: J. F. Cookingham (C. & E. I.), chairman; R. J. Bruce (M. P.); A. C. Cutler (N. Y. N. H. & H.); E. J. Fraser (N. Y. C.); B. W. Guppy (B. & M.); A. T. Hawk (C. R. I. & P.); L. P. Kimball (B. & O.); N. H. LaFountain (C. M. & St. P.); E. C. Morrison (S. P.) and R. J. Walsh (N. Y. C.).

Discussion

In discussing this paper a number of members outlined the forms of reports in vogue on the roads they represented. Among these F. C. Baluss (D. M. & N.) gave a detailed description of the record he maintains of the painting of buildings on his road. The value of photographs as a record of building maintenance was explained. A photograph will often show the conditions of maintenance in a manner that cannot be equalled with any form of written description. In this connection, F. E. Weise (C. M. & St. P.) described the use of photographs on his road to check up the condition of buildings along its lines in track elevation territory in Milwaukee and track depression territory in Minneapolis. Photographs taken before and after the construction work give an accurate check on any damage done to the building as a consequence of pile driving or other disturbances.

Labor-Saving Devices

INSUFFICIENT attention is paid to labor saving devices or those that increase output. It is the opinion of the committee that it would be a big step in the right direction if each individual railroad would appropriate a sum of money annually as an experiment fund with which to try out new equipment or ideas that appear to have substantial merit. No initial investment should be made in any labor saving device until it can be shown that it will produce a saving or will solve some particular labor problem. The chief difficulty in the way of providing and using labor saving devices where considerable investment is involved, is that economies are not always secured unless the device is kept in constant use. The distribution of equipment and labor saving devices should be

definitely under the direction of the division officers so that actual conditions in that locality may be given proper consideration.

There is no doubt as to the advantage in the use of motor cars by bridge and building gangs. Until recently, the motor cars in use did not have sufficient power and capacity and had too much speed. At present the designs measure more accurately to what is required under actual working conditions, and with the exercise of good judgment in the question of speed, the motor car is a valuable asset. Gasoline motor cars are of special value as a labor saving device in transporting men and material quickly; at times they replace a work train and abolish overtime. Varying conditions in different regions make the saving greater in some districts than in others. The proper care and upkeep of a motor is largely a personal equation of operation. The more complicated the construction of the car, the greater the cost of maintenance and upkeep and the less the value of the labor saved. Therefore, to derive the maximum of value from motor cars, they should be simple in construction, and of ample capacity, power and reasonable speed.

Motor cars save the energy expended in propelling a hand car, thus allowing the men to put more effort into their work. They improve the morale of the men by transporting them home for week end visits on lines where the train service is inconvenient and distances reasonable. Emergency work such as a partially burned bridge or a small washout can be repaired quickly by transporting both men and materials with motor cars and trailers without the delay of waiting for a work train. A number of roads use the larger sizes of motor cars, carrying about twenty men, to transport employees from the nearest station to the shop terminals, thus saving the daily expense of a train crew and the wear and tear on rolling stock.

More attention should be given to the use of pneumatic and electric motors for boring holes. Electric drills are probably the most convenient and economical to operate where the source of power is close at hand. The Michigan Central recently constructed a crib at Mackinaw City where all the boring was done by compressed air furnished from a locomotive air pump. The depth of the holes varied from 24 to 34 in. It was found by actual tests of hand boring and power boring that compressed air saved the equivalent of one man working 192 days in the drilling of 3,600 holes. The Northern Pacific uses electric motors to good advantage in boring for dowels in timber cribs. Holes 7/8 in. in diameter were drilled through 24-in. timbers in 40 sec.

In a recent test of tie dapping machines on the Michigan Central three men dapped 85 ties in 8 hours, which is about 50 per cent more than the same number of men could have dapped by hand. The New York, New Haven & Hartford estimates that this class of machinery effects a saving of 50 per cent in labor costs.

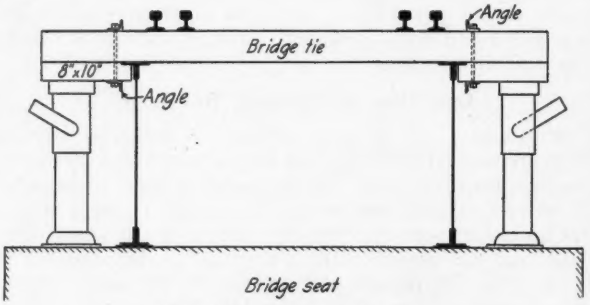
Many railroads have had considerable difficulty in keeping pails at water barrels on timber bridges. A bridge and building supervisor devised an inexpensive substitute for the pail by using a small dry goods box with a slat nailed across the top for a handle. Practically no losses of water boxes have been experienced since they have been substituted for pails.

The ditcher has demonstrated that it is exceedingly useful in places where a crane of one to two tons capacity is needed. It has been used as a pile driver, as a derrick for dismantling a light through truss, as a construction derrick on a long timber trestle and as a material loader with a clam shell bucket. Where lightness and speed of operation were essential the ditcher was the most economical machine for the job.

The St. Louis Southwestern uses a socket wrench for tightening and removing the nuts of chord bolts, brace bolts and guard timber bolts. A thorough test was made with steel socket wrenches and "S" wrenches in which it was found that socket wrenches effected a saving in labor of four cents per foot on the complete renewal of a trestle and required 40 per cent less labor to tighten the nuts on the new bolts.

To test scales at large freight houses where there are a great number to inspect, the New York, New Haven & Hartford uses a small four-wheel truck which will hold twenty 50-lb. weights. The loaded truck is used as the test weight and is moved to various points in the freight house instead of shifting individual weights.

A compressed air whitewashing machine is used by the Illinois Central for the whitewashing of fences and round houses, and disinfecting stock yards. The operation requires a crew of eight men. It is claimed that the machine will do the work 50 per cent cheaper than hand labor.



Jacking Up a Deck Girder Span

The drawing illustrates a method of lifting girders up to 50 ft. long. This scheme is especially advantageous in raising a span for changes in grade. The jacks are set at the end of the ties where they allow ample room for handling timber blocking and pedestals. This scheme saves the expense of erecting bents for supporting jacks. Before using this plan of lifting girder spans, due consideration should be given to the loads lifted and the strength of the top girder flanges and ties over the jacks.

Paint spraying machines were used on the Pennsylvania at the East Altoona engine house to coat slant panels in the ventilators at a cost of $0.029 per yard. If this work had been done by hand it would have cost $0.059 per sq. yd. The grand stand and bleachers at Altoona were spray-painted at a cost of $0.036 per sq. yd.

Bridge and building supervisors on the Missouri Pacific and the Union Pacific highly recommended a small stiff legged derrick mounted on a push car, equipped with hand winches and with the necessary clamps for clamping the push car to the track. This is an exceedingly valuable piece of equipment and one which should be placed with all gangs having to take care of pile trestle maintenance.

The self-propelled derrick car saves a great deal of labor by eliminating train crews and work trains. This machine, being slow, is not recommended for main line work at a distance from sidings. For yard work it is ideal while for other work its usefulness depends on the density of traffic to be dodged and the nearness of a siding. The average capacity should be 8 to 12 tons and the speed from 5 to 15 miles per hour. The greater speed is of advantage.

Locomotive cranes follow very closely the advantages claimed for the self-propelled derrick. Their scope is, however, broader and the average work which can be handled runs from 15 to 30 tons. The wrecking cranes are usually made use of where exceptionally heavy loads

have to be handled. The value of the locomotive crane lies in its adaptability to many uses. With a clam shell bucket it may be used for handling rubbish, coal or other materials or for excavation. For loading or unloading cars of gravel, cinders, coal and doing quick excavation, it is unequaled. Equipped with pile driver leads and a steam hammer the machine can do all of the work of the average pile driving outfit and with the air compressor and air tools it can handle sizable timber framing jobs at a considerable saving. One road estimated that its 20-ton locomotive crane speeded up the work to the extent that it paid for itself every 4½ months.

Pile drivers especially equipped as such are used where much work is to be done but with the readily converted locomotive cranes and derricks they are not always a necessity. It is found that the combination equipment fits the average work better.

Portable circular saws are good labor savers where sufficient work of one kind is to be done. For form work it is claimed that they save as high as 25 per cent of the cost. It has been suggested that these saws could be used to cut old bridge timbers into smaller sizes and thus reclaim considerable old material.

Acetylene cutting and welding outfits for bridge gangs have been reported as almost indispensable for those roads having to remove or repair old structures. The Boston & Maine estimates that repairs to a steel bridge can be made 50 per cent cheaper with this device than by the use of ordinary air cutting tools, especially if some of the parts in question are inaccessible to rivet busters.

Portable telephones have proven very efficient for bridge jobs at a distance from a station and where it is necessary to get advice from the dispatcher as to time that track can best be out of service. They do not relieve the foreman of any precaution against accident but help to keep the work running smoothly.

Tool grinders, using various sizes and grades of carborundum wheels, have practically displaced the grindstone on most roads. They are indispensable around a shop and a great time saver in the field.

Tinners' and slaters' tools are furnished only on those roads having a large number of building roofs to keep in repair. It is recommended that a full set be kept at division headquarters to be sent wherever needed.

Chain hoists are most useful around machinery and may be used to great advantage on draw bridges, pumps and boiler repairs. They are a great aid in removing heavy gears on draw bridges which happen to be in confined spaces.

Each gang should have a portable forge as most bridgemen can do the ordinary blacksmith work that is necessary, such as sharpening picks or bars, putting in a chain link and welding bolts, etc. Much time and annoyance are avoided by doing this work on the job rather than sending it to the shop.

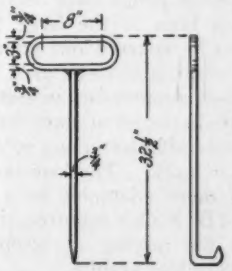
A very useful pulling machine has been employed by the Long Island and is recommended by that road for tying up pile clusters at ferry and transfer docks, lining and stay-lashing piles and the like. It is a small portable hand-operated affair which can be carried by two men and exerts a pulling power equal to a small steam hoisting engine.

Of the lighter portable compressors those used for the tampers seem to meet with the approval of several roads for adaptability to small bridge repairs up to 400 or 500 rivets and are reported to save 10 to 15 per cent over hand labor alone. For heavier work 9½ in. pump and cross-compound pump with three standard reservoirs was found to be a good combination where placed as accessories on the pile driver.

Electrically-operated tools are of great value where power is available. They have about the same range of use as air tools with perhaps a greater advantage where large power is needed. Electric welders are very useful and particularly economical in welding broken castings on pile drivers, derricks, draw bridges, and bridge pedestals. This device not only saves time in getting damaged equipment back in service but also reclaims considerable material that would otherwise be scrapped.

A large percentage of the roads have discontinued the use of hydraulic jacks for bridge and building gangs and replaced them with the ball bearing screw type. Unless the hydraulic jacks are kept in good repair the valves leak, causing unsatisfactory results. Screw jacks having capacities ranging from 10 to 25 tons will handle a large portion of the routine bridge work and should be furnished for every gang.

Where the volume of water is such that it can be handled by gasoline trench pumps, this class of equipment will not only save the expense of two or three men but also the expense of the original investment in a comparatively short period. Gasoline trench pumps are particularly adapted for sewer works, water works gangs, foundation work and mason gangs.



A Hook for Handling Wooden Stringers

The drawing shows a chord hook used in removing wooden stringers from bridges which have been filled and also in renewing chords and trestles. This simple device has proved exceedingly useful on the Missouri, Kansas & Texas. Changing stringers in 10 to 12 panels per day is considered a proper amount of work with the aid of chord hooks.

The most important field for improvement and cultivation lies in the opportunity to get men to think for themselves, to increase their efficiency and to instill a feeling of loyalty, as without these, any mechanical device is doomed to failure. Men should feel that their best interests are served by giving their employers efficient service and only as their employes succeed, can they share in their success. A healthy rivalry should exist among the different gangs with a notice of any particular job that was well done.

Committee: J. S. Huntoon (M. C.), chairman; S. C. Bowers (Penna); E. Cahill (D. L. & W.); B. L. Johnson (G. N.); D. L. McKee (P. & L. E.); S. C. Tanner (B. & O.) and D. T. Wells (O. S. L.).

Discussion

The economical operation and maintenance of motor cars occupied a considerable portion of time devoted to the discussion. S. R. Young (A. & W. P.) related the experience on his road with wide variations in the cost of operating and maintaining cars. Thus the cost of operating section motor cars ranged from $10 per mile per year, to as much as $35, while the consumption of gasoline in a given period varied from 8 gal. to 30 gal. One explanation for this offered by G. W. Andrews (B. & O.) was the possible diversion of some of the gasoline to other purposes. E. K. Barrett (F. E. C.) suggested that this could well be overcome by having the storekeeper mix

the lubricating oil with the gasoline before it is issued, thus making it unsuitable for almost any other uses.

J. P. Wood (P. M.) said that it was his experience that the cost of maintaining motor cars depended greatly on the personal equation. If a man was mechanically inclined and took an interest in his motor car it would last a great deal longer and cost less to maintain than if he gave it no intelligent attention.

Driving piles with the aid of leads suspended from the booms of various types of derricks or cranes was favored by some of the members, especially when driving from the decks of truss bridges, where the ordinary pile driver could not be used. However, G. W. Rear (S. P.), expressed the opinion that there was no substitute for a real pile driver in all cases where nothing interfered with its use. He also testified to the economy of power tools. He said it was his opinion, that in most cases, pneumatic tools would be superior to electric tools, entirely aside from any question of the availability of the power. The pneumatic hammer, he said was far superior to anything that had been developed to do the same work in electric equipment. Mr. Rear said that the critical feature of the pneumatic equipment is the air compressor. In the past where railroad bridge gangs have been supplied with the compressor it has been of the large type, housed in a car which had to be spurred out on a temporary track near the bridge where it is to be used. There was need, he said, of portable compressors mounted on skids. Concrete mixers were discussed at some length, with the presentation of considerable testimony to their value on railroad maintenance work. The one-sack capacity mixer was favored as most adaptable to railway conditions. A. B. Scowden (B. & O.) reported the use of the concrete mixer for the mixing of bitumen road crossing materials with excellent results.

The Relative Merits of Wooden, Steel and Concrete Tanks

THE first railway water tanks were built of wood and, while other materials are now being used, it is safe to say that the wooden tank will never be discarded entirely. Cypress, red cedar and white pine are suitable tank materials and many instances may be cited in which these woods have given unusually long service. While this is interesting information it is of little help to us at the present time because we can no longer secure the same grades of lumber. To offset this, many railroads are building tanks of treated material with very satisfactory results.

The advantages of the wooden tank are manifold. In the first place, it is the cheapest form of construction and that, in many cases, is the governing factor, especially if there is any doubt as to the permanency of the location of the water station. A wooden tank is easily constructed and a carpenter crew assigned to this work soon becomes skilled in its erection. As wood is a poor conductor of heat and cold, it is a desirable material for tanks in cold climates as the water can be kept from freezing more easily. It is not considered practicable to build a wooden tank of larger capacity than 100,000 gal. Untreated wooden tanks are subject to decay. Corrosion of the hoops also takes place. The wooden tank carries a certain fire risk and is likely to be damaged or destroyed by fire in the frost-proofing or by the burning of adjacent buildings.

Creosoted Wooden Tanks

The increasing scarcity of suitable timber for the construction of tanks, together with the increased cost, has resulted in a number of railroads constructing creosoted tanks, this type of tank now being standard on at least four railroads. The first creosoted railway water tank of which there is any authentic record was constructed by the Cleveland, Cincinnati, Chicago & St. Louis at Sidney, Ohio, in 1907. This was a comparatively small tank, having a capacity of 25,000 gal. The staves and bottom plank only were creosoted, the substructure being of steel. This tank was considered an experiment at the time it was built, but it proved so satisfactory that the creosoted tank was finally adopted as standard. Creosoted tank are now being built in sizes up to 100,000 gal. capacity. The Illinois Central has 31 creosoted tanks in service and 12 more now under construction.

The advantage of the creosoted tank over the untreated wooden tank is that any timber that will take treatment can be used, thus making the cheaper timbers available for tank construction. Where the entire structure is creosoted there should be considerable reduction in maintenance as the life of the structure will undoubtedly be much greater and there is no necessity for painting any part but the hoops.

The need of larger reservoirs than could be made safely with wooden staves led to the construction of the sheet iron and steel tanks, beginning about thirty years ago. The steel tank has been serving its purpose admirably and while it has some drawbacks, it is a good tank material. The steel tank can be made of almost any desired capacity and has the advantage that it can be built quickly and is not excessively expensive. It must be frankly admitted that it is subject to corrosion and for that reason must be kept well painted both outside and inside. If there should be any neglect in this respect much harm may result. Reports indicate that steel tanks pass through severe freezing winter weather successfully and only the usual precautions for keeping the water from freezing need be taken.

The first reinforced concrete tank was built in this country in 1899. In June, 1910, a statement was made before the Boston Society of Civil Engineers that only 53 had been built in this country and abroad up to that date. Since then many more have been constructed, but not as many as the general use of concrete in other lines of construction would lead one to believe. Experience has shown that they are generally successful.

Concrete tanks for railroad purposes are not being given general consideration for various reasons. Very few railroad water stations can be considered permanent because experience has shown that operating conditions are constantly changing, requiring frequent and unexpected changes in yards and tracks. A concrete tank cannot be moved and therefore if the permanency of the location is at all doubtful, it ought not to be built. It is also the most expensive type of tank and as the item of initial cost is often the governing factor in a decision, other types are used instead.

The great problem of the concrete tank is to secure a perfectly water tight reservoir. The first tanks built, as a rule, developed considerable seepage, due to the development of cracks in the concrete after the tank had been filled with water. While in some cases these cracks gradually filled up, especially where the water contained limestone in solution, many of the early tanks had to be coated on the inside with some water-proofing composition. As far as the committee knows, no tanks built recently have been waterproofed by coating the inside.

Much speculation has always existed as to the effect of severe winter weather on concrete tanks. Many such tanks are in service in northern climates and seem to give no more trouble than tanks of other types. In fact, some claim that the concrete tank stands up better than the wooden tank.

The construction of the concrete tank requires good workmanship. Most difficulties with concrete tanks can be traced almost directly to faults in the construction and it is therefore necessary that the work must be watched carefully during the construction period.

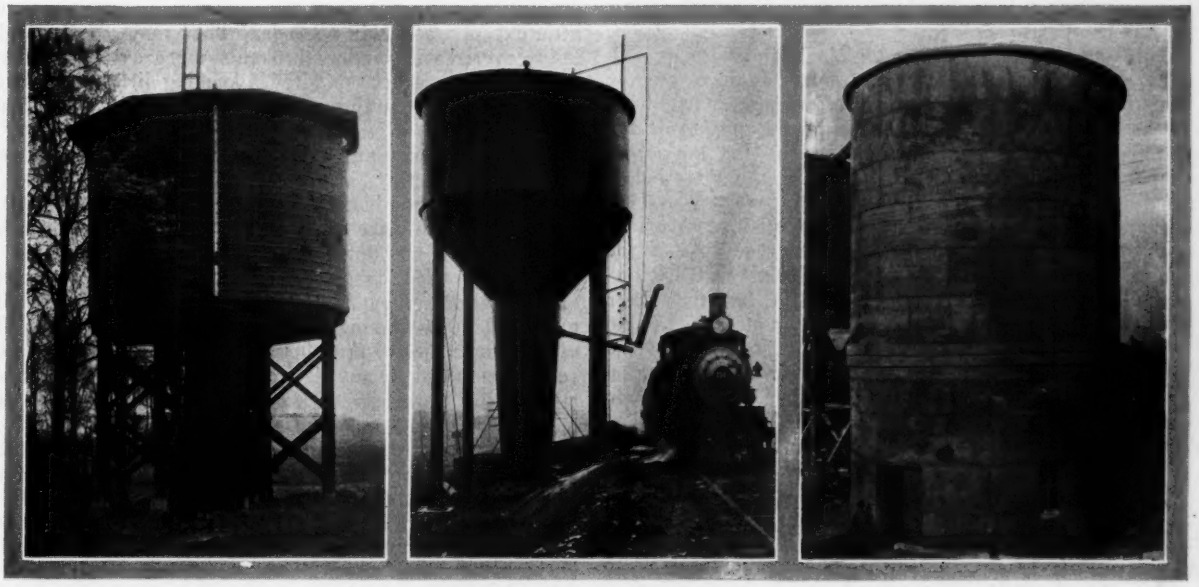
Conclusions

It is difficult to attempt to establish a basis of comparison between concrete, steel and wooden water tanks with a view of making a definite recommendation because of the number of factors to be considered such as first cost, maintenance, size of tanks, height of tower, location, character of water, future developments, etc. While the first cost of the tank, of course, deserves careful consideration it is by no means the dominant factor and the other essentials should always be given careful consideration.

A concrete tank will invariably represent a greater first cost than either a steel or wooden tank, yet this first cost is offset to a large extent by a far lower maintenance cost as it is a permanent structure with a life of perhaps 100 years as compared with other tanks having a maximum life not to exceed 50 years. One great disadvantage of the concrete tank is that it cannot be moved after erection. Thus, its very permanence is, to a certain extent, an argument against its use in many cases.

While the concrete tank is admittedly more expensive than the steel and wooden tank and its greater life and lower maintenance cost are firmly established the relative cost and durability of steel and wooden tanks is still a matter of controversy. An average life of 30 years may be expected of tanks constructed of white pine, cypress, and redwood, while the other untreated timbers used in the construction of tanks will have a life not to exceed 15 years. Properly treated timber will have a life of at least 30 years and probably more. Steel tanks for railway water service have only been constructed during the past 30 years and as some of the first steel tanks constructed are still in service the minimum life of a steel tank properly painted can be based upon this figure with a minimum life of 40 to 50 years, always dependent on proper painting and maintenance. Many of the old style flat bottom steel tanks have failed through the bottom rusting away, and the figures on the life of the steel tank are based upon the modern conical bottom tank.

A feature of primary importance in the selection and construction of a water tank, and one that cannot be emphasized too strongly, is material and workmanship. This is particularly true of wooden tanks. Rigid inspection of the timber entering into the construction of the tank is necessary if the maximum life is to be obtained. A few poor staves or bottom plank will materially shorten the life of the tank; poor framing and erection, necessitating the use of foreign material for calking, will also hasten decay. The same thing is true of steel and concrete tanks. As previously stated most of the difficulties experienced with concrete tanks can be traced directly to faulty construction. The manufacture of steel tanks has been developed to such an extent that one is reasonably sure of good material and workmanship as the material furnished by most manufacturers is uniformly up to standard specifications and the construction is usually done by workmen skilled in that particular line of work. The construction of concrete and wooden tanks is sometimes performed by workmen who are no doubt skilled in ordinary concrete work and generally carpentry and building but perhaps do not fully understand the requirements of tank construction. Conditions encountered on the average railroad vary to such an extent that it would be unwise to establish any particular type or kind of tank as standard without regard to local conditions.



Three Types of Railway Water Tanks

Committee: F. A. Eskridge (C. & E. I.), chairman; C. P. Rawson (C. M. & St. P.); F. M. Case (C. & N. W.); L. A. Cowsert (B. & O.); James Dupree; D. D. Everett (Erie); J. F. Luxton (P. M.); Emil Oetzman (A. T. & S. F.); A. A. Seay (S. A. L.) and E. A. Demars (O. S. L.).

Discussion

Most of the discussion of this paper centered on the practices followed in the construction of creosoted wood tanks. In answer to questions, C. R. Knowles (I. C.) reviewed the methods in vogue on the Illinois Central. He said that the timber for tank tubs was now treated by the full cell process, using timber with a high percentage of sapwood, and that with three inch staves the penetration was found to be practically complete in 75 per

cent of all samples taken. He stated further that no trouble had been encountered as a result of warping of the timbers as a consequence of the treatment and that this twisting or warping could be avoided if the timber was properly seasoned before being treated.

In discussing the steel tanks, G. W. Rear (S. P.) said that his road had used steel tanks for 35 years and that all erected were still in service and that he had no fault to find with any of them. When asked with regard to program for painting, he said that he believed in giving careful attention to the initial coats. That if these were properly applied, the tanks required less attention afterward. There was also some discussion of the use of special coatings in cases where the water had particularly corrosive tendencies and in this connection Mr. Rear stated that it paid to use the best material to be had even though the price was high.

Questions with respect to the relative cost of steel, wood and concrete tanks gave expression to the thought that prices have been so variant during the last four or five years that it is impossible to obtain data that permit of fair comparisons.

In discussing the concrete tanks, Leland Clapper (D. & I. R.) reported favorable results obtained on the Duluth & Iron Range with reinforced concrete tanks built in the form of a simple cylinder from the ground line to the top, the structure being divided by the horizontal diaphragm to form an elevated tub with the space below used as a pump house. This not only gave a very permanent tank, but also proved economical in comparison with other forms of construction when the cost of the pump house was taken into consideration. O. H. Dickerson (D. & I. R.) called attention to the fact that there are often opportunities for building a concrete tank on the side of a hill or at the top of a cut, where the necessary elevation can be obtained with the tank set on the ground surface or partly buried. Tanks built in such locations are not only cheap but when partly buried are afforded effective protection against freezing.

Construction and Maintenance of Sewers and Drains

A SEWER is a conduit for carrying excrement and other waste matter from railroad buildings to a main sewer, stream or cesspool, and because the matter carried is foul, offensive and injurious to health, the sewer must be well built in order that the foul matter will not seep into the surrounding soil or the gases escape where they will do harm. Drains, on the other hand, are conduits that carry off surplus water from buildings, pits and station grounds, and are more simple in construction in that the joints are not necessarily tight and the pipe may be of cheaper material.

Materials

Vitrified, salt glazed, sanitary sewer pipe is undoubtedly one of the best materials for general sewer work, requiring sizes from 4 in. to 3 ft. in diameter. The cost is reasonable. It is hard, substantial, smooth, impervious to liquids and gases, and is not affected by the water or chemicals carried in the sewage. It is easily handled and the joints can be made practically smooth and water tight. All vitrified pipe should be salt glazed inside and out, sound and well burned throughout its thickness, impervious to moisture, smooth and free from cracks, flaws, blisters and other imperfections, circular in bore and true to form. Vitrified sewer pipe is also made in an extra heavy type for use where the loads to be carried require something stronger than standard pipe but do not warrant the extra expense.

Two methods of making joints in vitrified sewer pipe lines are in common use. One is known as the cement joint and the other as the sulphur joint. The cement joint is probably more commonly used, as it is somewhat cheaper and easier to make. It, however, does not make as tight a joint as the sulphur joint, and as it takes considerably longer to set up, greater care must be taken not to move the pipes or allow the water to come in contact with the joint for a much longer period of time after application than with the sulphur joint. The sulphur joints make a much more rigid line and greater care must be taken to see that the pipe is properly bedded, as any uneven supports may cause breakage of the pipe.

Common drain tile are straight, unglazed, porous, earthen ware, hard burned and sound and of standard 1-ft. lengths, or they may be of suitable hub and spigot pipe in 2-ft. lengths. They are usually laid with either open joints or with a covering of cheese cloth which will prevent dirt getting into the tile until such a time as the ground has formed around the tile in such a manner that little except water will wash in. They may also be laid in or covered with cinders, broken stone, gravel or similar material that will act as a filter in keeping dirt from entering the tile. Tile drains are used as sub-drains for other pipe lines which it is desired to keep dry, also for carrying the water away and drying out wet areas which have no natural outlet.

Concrete sewers, both of manufactured pipe and monolithic (poured-in-place construction) have come into much more common use during the past few years than previously. Poured concrete sewers fit the irregularities of excavation, giving better foundation; are constructed monolithic, thus making them less liable to settlement and opening up in joints than brick and masonry sewers; are readily moulded to any desired section and can be constructed by fewer skilled workmen than other types of masonry sewers.

Manufactured concrete pipe is also coming into more common use for sewers from 3 to 6 ft. diam., but for larger sizes the bulk weight, cost of handling and liability of breakage becomes so great that poured-in-place construction is much more satisfactory and economical. In both the manufacture of concrete pipe and in the installation of monolithic, poured-in-place concrete sewers, the greatest care should be used in the proportioning, mixing and placing of the concrete. The inverts of large-section concrete sewers should be protected by a course of hard burned vitrified sewer brick or block and the remainder of the surface, both inside and out, treated with an approved waterproofing.

Brick sewers have been used extensively in the past for those over 3 ft. in diam., but sewers of this size are now more commonly built of concrete on account of being more economically constructed and being better sewers when completed. Brick sewers should be constructed of hard burned brick of a good quality. The bricks are laid with the 4-in. dimension radial and the 8½ in. dimension lengthwise of the sewer, care being taken to break joints in each ring when two or more rings are laid. Brick should be laid in Portland cement mortar, consisting of 1 part cement to 2 or 3 parts sand.

Cast iron sewers or drains are used for drainage fittings and sewers inside building walls in order that there can be no possible escape, through leakage, of either sewage or sewer gases, and in places where greater strength is required or uneven settlement is likely to occur, such as when sewers or drains are carried through or under foundation walls; also where sewage is forced through the mains under pressure for any reason. It has also been found that where hot water is carried it is well

to use cast iron as vitrified pipe is very apt to break and concrete pipe to disintegrate.

Laying Sewers

In laying or placing sewers every care must be taken to see that the grade of the invert in final position conforms to the grade established by the engineer and also that it is not only laid to conform to the established grade but that the sewer is bedded or supported so that it will remain true to grade after backfilling.

All pipes must be laid so that the joints are as close as possible and butt all the way around, and special care should be taken to see that the spigot end does not sag in the hub and that a true surface, corresponding to the established grade, is secured in the invert. All joints must be wiped perfectly clean of mortar before any set has taken place in order that the completed inside surface will be as smooth as possible. Every care must be taken to see that the sewer is not in any way disturbed between the time of laying and back filling. Back filling must not be started until the joints or work has had sufficient time to set so that it will not be disturbed by back filling. Adjacent to the sewer selected material should be used, which will pack in with the smallest percentage of voids and which will distribute uniformly over the sewer any load that may be applied. Better results can be obtained in back filling if the material is all carefully rammed and in materials where water will readily drain away it is a great aid to use it while back filling. It should not be used, however, in a clay soil.

Committee: W. B. Hotson (E. J. & E.), chairman; L. Beck (Va.); A. J. Catchot (L. & N.); J. A. Doyle (D. & H.); Paul Eberst (K. & M.); Albert Fink (D. L. & W.); J. L. Pickles (D. W. & P.); H. C. Swartz (G. T.); P. N. Watson (Me. Cent.) and J. C. Williams (Ga. R. R.).

Discussion

J. S. Robinson (C. & N. W.), E. H. Brown (N. P.), F. C. Baluss (D. M. & N.), O. H. Dickerson (D. & I. R.) and others emphasized the necessity of the correct charting of all sewers and other underground pipe lines, citing instances where large expenditures have been necessary to locate lines of which correct records were not available.

Framing Timbers Before Treatment

ONE of the developments that will come about with the general use of treated timber, is the framing of the timber before treatment. This is logical because it is the result of experience and eliminates the cutting in the field that has caused many failures in the past. It is also desirable because it permits the use of machinery in place of hand work in framing the timber. It is an important development because it will involve great changes in present methods. It means that the bridge carpenter will no longer take an assortment of lumber to the job, remove decayed material and replace it by new material cut to fit, but that the lumber will be cut and framed at the mill and sent to the job ready to be placed. The field men will be erectors rather than carpenters. The structures will be built with more care and with an expected life of 30 to 40 years rather than 6 to 15 years.

Few railroads have so far adopted treated lumber for general use, but it is to be expected that before many years it will come into general use on all railroads: (1) because lumber is the most important material used in the bridge and building department, and will probably not be displaced to any great extent by other materials in the future; (2) on account of the rising cost of lumber the railroads cannot afford to use it untreated, and allow it to decay in the structure as at present; and (3) on account of the increasing scarcity of the better grades needed for use when untreated, it will be necessary to use the poorer grades which become suitable only after treatment.

Causes of Decay

We treat lumber to protect against decay. It is expensive and the results must warrant the expense. Experience teaches that we cannot get the results we want unless we observe certain precautions in preparing timber for treatment, in treating and in handling and working it afterwards. Treating processes have received a great deal of study and are fairly well standardized, but there is room for more study and care in the preparation of lumber for treatment. In handling lumber after treatment, experience has shown what to do, and we should

Decay Around a Bolt Hole in a Creosoted Stick

now get this information to the inexperienced workmen, and make them appreciate that when working treated lumber they are no longer using plain lumber, but an entirely different material.

Decay starts from the outside. It is not necessary for the preservative to penetrate completely and to poison all of the wood; in fact, it is not usually practicable to obtain complete penetration, but if there is an impervious armor of treated wood on the outside, surrounding the untreated wood, there will be no decay. If, however, there is a hole in this armor, caused by a crack, an injury, or by cutting or boring, that exposes the untreated wood, decay will take place if the other three conditions are favorable, and they generally will be.

Current Practice in Treating and Handling

The ideal way to build with creosoted lumber would be to make complete detail drawings of each structure to fit the individual location. This would permit the framing of each member before treating. It would not be practicable to do this with pile structures since it is necessary to cut off piles to proper elevation after they are driven, and also because the piles cannot always be driven exactly in the desired location. For pile structures, then, the ideal way is to drive the piles and cap them, and measure locations, then frame the balance of the structures to fit these locations and then treat the framed lumber. This idea is being carried out on some railroads in building small structures, such as highway bridges, water tanks

and coaling plants, but it has not been applied generally to bridges and trestles, where the bulk of the lumber is being consumed. In these structures it is the general practice to provide treated lumber in stock sizes and cut and bore in the field as may be necessary.

Piles are cut off and bored after they have been treated and driven. Field protection must be relied on to prevent decay starting at the cut surfaces. They usually have to sustain severe moisture conditions, and they should have a good treatment, which means a uniform penetration of the oil all the way around.

The replies to the questionnaire indicate that there is some question as to the desirability of treating bridge ties. It is of no benefit to treat timber that will wear out before it will rot if untreated. Ties on open deck structures suffer considerable wear. They are cut by the tie plates and by the spikes, and they are sometimes scarred by derailments early in their life. In fact, it often appears that new bridge decks have to be initiated into service by sustaining a derailment. They are often damaged by running rails and many good bridge ties have been split open and ruined in this way. Furthermore, they are exposed to fire dropping from locomotives, and it is probable that treated ties, when they are new, form a greater fire risk than untreated ties. There is no difficulty in framing ties at the mill before treatment, and dapping them properly to take care of the camber, cover plates and rivet heads, but it is probable that in some cases where the steel work is irregular, the dapping, if not the boring, should be done in the field, if the lumber is pine. If the treating is done at a company owned plant there is no reason why ties after being dapped in the field to fit irregular steel work could not be sent to the treating plant, but if the treating is done at a commercial plant this would usually not be practicable. Ties on timber trestles can be framed and bored complete at the mill before treatment.

Guard timbers can be framed and bored at the mill, but where the tie spacing is irregular, as frequently obtains on metal bridges, it may be necessary to have the framing and boring done in accordance with a carefully prepared drawing.

For open deck pile trestles, when the panel lengths are not exactly regular, it is usually safe to provide the stringers in standard lengths, and to cut and bore them in the field, if the lumber is pine; but with Douglas fir, which lends itself less readily to field treatment, it is advisable to cut and bore to exact length before treating. For open deck frame trestles, the bents can be spaced uniformly, and the timber cut and bored to standard length before treatment. The above holds true also for ballast deck trestles, of the type where the stringers are laid solid and butted over the caps, but in the type where the stringers are laid open and are lapped over the caps with a plank floor, there is no difficulty in framing them complete in standard lengths at the mill before treatment.

There is no difficulty in framing and boring bents of frame trestles at the mill, but the members would generally have to be match marked and this adds somewhat to the supervision necessary.

It is practicable to cut and frame longitudinal struts in standard lengths before treatment, except when they are to be used in connection with pile bents, and the piles have been badly driven. In these cases it may be necessary to cut and bore in accordance with measurements taken in the field.

Bracing planks of pine are usually completely penetrated and may be cut in the field with little danger. Douglas fir planks are, however, not usually completely penetrated, and since it is generally necessary to cut bracing plank in the field, and since this lumber has a fairly long life without treatment, one road recommends against treating Douglas fir bracing plank at all.

Several roads report extensive use of creosoted wood box culverts, many of which are 25 to 30 years old. The very few instances of failure of these culverts occurred when the timber was cut after treating.

Treating in the Field

While it is true that most of the failures of treated lumber seem to be attributable to careless handling or cutting in the field, it is also true that it is practicable to protect these exposed surfaces of pine lumber efficiently by coating them in the field. The replies to the questionnaire indicate a fairly uniform practice for protecting creosoted pine lumber in the field, which consists in coating the cut surfaces with 2 or 3 coats of hot creosote oil and then with hot coal tar pitch. This is sometimes followed on ends of piles by a covering of tarred paper or galvanized iron. No instance is reported where treated pine timber cut in the field and protected in this manner has decayed afterwards. For Douglas fir this field treatment should be avoided wherever possible.

Conclusions

1. In the replies to a questionnaire, all roads advocate the framing and boring before treatment as far as practicable.

2. It is practicable to frame and bore before treatment the timber in all classes of railroad structures, but it may be necessary in badly driven pile trestles, if cutting after treatment is to be avoided, to frame certain members in accordance with measurements taken after the piles have been driven.

3. All treated lumber should be handled carefully. Piles and other heavy sticks are likely to suffer more from rought handling than lighter sticks. They should be handled with chains and not with timber dogs or cant hooks. They should not be dropped from cars, as they are likely to be bruised or cracked.

4. All holes for bolts bored before treatment should be 1/16 in. larger than the bolts. Those bored after treatment should be the same size as the bolt and should be protected thoroughly by pouring hot creosote oil into them. Oil can be poured into horizontal holes by using a bent funnel.

5. Ties are likely to suffer considerable wear, particularly if proper track fixtures are not used. Tie plates should be used that are adequate in size and without claws to cut into the wood. Spike holes should be bored and filled with creosote oil before driving the spikes. All unfilled holes should be filled with creosoted plugs. Rails should be well anchored on approaches to prevent running as much as possible.

6. The committee recommends ballast deck trestles as against the general use of open deck trestles of treated timber. While the fire risk with open deck trestles of treated lumber is probably no greater than with untreated timber, when the structure is destroyed the loss is greater. With ballast deck timber trestles experience shows there is comparatively little risk from fire.

7. The committee recommends against the use of treated lumber with plain lumber in the same structure, in situations where it would be necessary to rehandle and refit the treated lumber when the untreated lumber is renewed.

This does not apply to the use of treated piles used in trestles along with untreated lumber.

Committee: A. B. Ilsley (Sou.), chairman; H. H. Harman (B. & L. E.); George W. Rear (S. P.); Herman von Schrenk (Cons. Engr.); A. B. McVay (L. & N.); C. F. Womeldorf (C. & N. W.); G. C. McCue (G. T.); R. E. James (L. V.); R. F.

Farlow (B. & O.); A. G. McKay (N. Y. N. H. & H.) and E. L. Loftin (A. & V.).

Discussion

R. H. Reid (N. Y. C.) said that it was his practice to provide for the framing and match marking of all timbers for highway over crossings before the timber was treated and that no timber was punctured in any way after treatment, except for the driving of spikes. George Rear (S. P.) brought out the fact that the framing of timbers before treatment is not new; that the necessity for doing this was appreciated by the early advocates of timber preservation. He described in detail the pains taken on the Southern Pacific to teach the men to avoid abuse of the timbers, and pointed out the difficulties in eliminating this. Most workmen on railway bridges are so accustomed to cutting into piles and timbers or to puncture them with the cant hook or other tools that it is extremely difficult to get them to change their habits. He also pointed out how very important it is to avoid the abrasion of piles placed in waters infested with marine borers. This is particularly true with Douglas fir, which does not absorb the preservative readily, even with the best pressure process, with which a coating or brush treatment to cover up cut places is of little value. Mr. Rear also stated that his inspection of structures built of creosoted timbers showed that the failures in nearly all cases can be ascribed to instances of rough or careless handling of the timbers after treatment.

Painting Structural Steel

THERE is probably no form of steel construction that is subjected to corrosion more than the railroad bridge. In fact it constitutes the most serious problem the railway painter has to cope with. It is largely because shop painting is frequently done over dirty, oily or wet surfaces that many bridges must be repainted soon after the field coat is applied. It frequently occurs that structural steel is fabricated and stored in the open for long periods before erection, with no protection other than the shop coat of red lead. Therefore, the steel is often in a stage of corrosion by the time it is erected.

On overhead bridges where the locomotive smoke stacks pass only a few feet below the metal surfaces, the paint deteriorates very rapidly. Some of these bridges are wide and often no provisions are made for ventilation. Therefore the smoke and gas become pocketed between the girders and the destructive action is very severe. Corrosion will be found in heavy layers, which are generally in a moist condition due to the steam exhaust and can only be removed with scaling hammers, chisels and much effort. It is found that where the corrosion scale is dry it can be removed with much less effort and sometimes falls off. The cinder blast, however, must be treated in a different manner. No paint or concrete can be expected to resist the most severe conditions. In such cases shields of cast iron or steel plates, asbestos or lumber are generally erected directly over the tracks, receiving the blasts from locomotives, which can be renewed when worn through.

There seems to be no definite law governing the intervals between painting. Some roads repaint at intervals of 2 to 4 years; some at 8 or 10 years, others at 5 to 15 years. Climatic conditions have a large influence. Bridges located in the open or arid regions do not need repainting as frequently as those in humid districts, or in locations where the air is heavy with furnace gases and where they are subject to salt fogs or are submerged at high tide. On some roads, unfortunately, the bridges are not repainted until the previous coating has almost disappeared, while other roads adhere to a system of spot painting and defer the complete repainting at a material saving by a systematic touching up from time to time of parts subjected to the quickest deterioration. In this way the expense of cleaning and chipping rust is largely avoided. Bridge painting does not require the skill and trade knowledge of a painter, but considering the vast expense involved in cleaning rust and preparing the surface, it is very important that the paint be applied properly and with care. On some railroads detailed instructions are issued specifying the manner in which the work shall be done. In view of the fact that unskilled help is often hired for this class of work, the benefits of such instructions cannot be doubted. The economy and quality of the painting depends largely upon the judgment and experience of the painter foreman.

Cleaning

The importance of a perfectly clean metal surface cannot be emphasized too strongly. All foreign substances should be removed. But this is not always possible by hand cleaning and perfect conditions cannot always be obtained. It is therefore left largely to the judgment of the foreman just how far the cleaning process should be carried out. All rust and scale, blistered or checked paint should be removed. Old and heavy coats of paint in a checked condition can be removed with a blow torch or a strong solution of lye. Care should be taken that the lye is thoroughly washed off before repainting.

The sand blast affords the simplest means for securing an absolutely clean surface. Its primary object is to remove the tight sticking rust and thin scale and to thoroughly clean the surface. In past years the sand blast was not favored on bridge work because of the loss of sand after it had been used, and although it is apparently still in the experimental stage many of the difficulties have been overcome.

The use of the spray machine is fast gaining favor for bridge painting. It has a great advantage for reaching inaccessible places and getting into cracks and corners, and it is more workable than it formerly was, but most painters are satisfied with a well-brushed job done by an experienced man with a good brush in favorable weather.

Committee: E. G. Storck (P. & R.), chairman; E. S. Airmet (O. S. L.); Charles Ettinger (I. C.); George M. Hoffman (P. & R.); George Montgomery (G. T.); B. D Rich (S. P.); W. W. Turnbull (G. T.); William Gray (L. I.); G. W. Heuss (C. C. C. & St. L.); A. J. James (A. T. & S. F.) and G. J. Klumpp (N. Y. C.).

Discussion

G. W. Rear (S. P.) advocated the more general practice of spot painting, stating that a few men can keep a structure in service for a long time with relatively little attention, if the deterioration in the painting is arrested at its inception. To do this to best advantage he contended that a road must have a standard paint of uniform quality for use year after year. A number of members referred to the difficulty of taking steel water tanks out of service long enough to enable the interiors to be painted properly. The need of a quick drying paint for such work was emphasized.

Handling and Driving Concrete Piles

WITHIN recent years the construction of timber pile trestles has generally been confined to small and unimportant streams, swampy lowlands, and wide flat drainage areas. In such localities spans can be made relatively short and a standard trestle with bents of 14 to 16 ft. is well adapted and economical. Concrete pile trestles with bents of 14 to 20 ft. spans can and are being constructed very economically to replace these wooden spans. In addition to being fireproof, they require no maintenance.

One of the principal advantages of concrete pile trestles is the fact that the piles and slabs can be cast in one central yard, seasoned and then hauled to the bridge site and put in place with an outfit which can be moved readily as required. This makes the hauling and storing of large quantities of material and the erecting of a costly plant at each site unnecessary. When piles are made in this manner close to sources of supply of sand and gravel or in the gravel pits themselves the installation of the plant is distributed over a greater number of structures. Another important advantage of concrete piles is the fact that they are not restricted to a cut off below permanent low water line in order to insure permanency as is the case with wood piles. While the cost of the concrete pile is greater than wood this is more than offset by the fact that, owing to their size and shape they are capable of sustaining greater loads; there are also savings in excavation, pumping, sheathing, masonry, etc.

The Chicago, Rock Island & Pacific reports the use of Raymond concrete piles under high retaining walls, abutments, and column foundations on Chicago track elevation work. Precast piles have been driven under bank blocks at the end of the bridges and under deep ravines where it would be impracticable to maintain wood piling on account of absence of moisture.

The Illinois Central employs precast piles in trestles, piers, and abutments. The piles are octagonal in shape, 16 in. in diameter and vary in length from 20 to 40 ft. Eleven thousand piles have been used to date in the construction of 22,072 lin. ft. of single-track concrete pile trestles, 3,747 lin. ft. of double-track concrete pile trestle, 248 lin. ft. of three-track concrete pile trestle, six concrete pile abutments and eight concrete pile piers for girder spans. Piles are left on the platform 21 days after being cast and are then stacked in the yard for curing, being handled with a locomotive crane and a bridle carrying two pair of tongs so that the pile is supported in two places. Piles are loaded on cars in the same manner and are unloaded with pile driver derricks, using a similar method of handling. They are driven 60 days after being cast and are handled by making one hitch near the top of the pile. Driving is done with a standard pile driver, using a No. 2 Warrington steam hammer assisted, where material permits, by an ordinary pipe jet along side of the pile to increase progress and secure good penetration. To protect the head of the pile an extension cap or hood eight feet long with an oak follower block and rope cushion is used.

On the New York Central Lines West precast concrete piles have been used for foundation work supporting piers, bank blocks, abutments, buildings, etc. They are handled about the same as the ordinary wood piles except more carefully. Both steam hammer and jet have been used in driving but in a few cases where the steam hammer could not put the piles down to what was considered a safe distance a 3,500-lb. drop hammer was used. For protection, a short oak pile cap having a cylindrical hood made of boiler iron fastened on it was used to hold the cap on the pile. In addition a cushion of old rope was used between the pile cap and the concrete pile, the cushion being made by coiling the rope to the size of the head of the pile. When piles were jetted the same outfit was used as in jetting the ordinary wood pile. Not over one per cent of the piles were broken.

M. K. & T. Practice

On the Missouri, Kansas and Texas, the concrete piles used are octagonal in shape, about 18 in. in diameter and about 26 ft. in length. Driving is done with a Bay City pile driver and a No. 2 steam hammer. Driving in one case mentioned was very hard, making it necessary to dig a hole about four feet deep for each pile and filling it with water to soften the ground. The hammer used a steam pressure of 140 lb. It was necessary to strike from 1,800 to 2,800 blows on each pile to secure 16 to 20 ft. of penetration.

These piles were loaded on flat cars cleated with 2 in. by 6 in. timbers between each layer of piles. For round or octagonal piles 3 in. by 6 in. cleats were used, two such cleats being placed between each layer of piles about one-fourth of the length of the pile from each end. In addition the side stakes were wired securely at the top. Piles are not loaded out until they are cured from 30 to 45 days and no pile is driven until it has cured 50 to 90 days. In handling they are picked up, loaded and unloaded at the bridge site with the derrick, rolling or dropping them off cars never being permitted. Experience with the piles is the basis for a recommendation that a cushion be used on top of concrete piles, made of 1½ in. or 2 in. oak plank sawed out circular to fit the recess in the driving head, in addition to about 8 or 10 pieces of old rubber belting of the same diameter. In case the pile head begins to spall it may be necessary to cut off the injured portion, including the reinforcing bars and then proceed to drive on the newly-formed top. Jetting is effective only where sand or gravel is encountered and a steam hammer should be used only when jetting can be employed effectively. In localities where there is shale

On the Florida East Coast Railroad piles are driven with a 6,500-lb. steam hammer with a rope cushion. Experience indicates that concrete piles will give good service if they are driven in sand so that they can be jetted, but in driving in rock or even soft coral rock poor results were had.

Committee: T. H. Strate (C. M. & St. P.), chairman; Maro Johnson (I. C.); A. S. Clopton (M. K. & T.); S. T. Corey (C. R. I. & P.); O. F. Dalstrom (C. & N. W.); A. W. Reynolds (Penna.); R. E. Sheehan (C. B. & Q.); R. H. Reid (N. Y. C.); E. E. Brink (L. E. & W.); E. H. Brown (N. P.) and J. K. Melton (I. C.).

Discussion

The report was followed by the presentation of moving pictures showing the driving of concrete piles on the Illinois Central. The discussion of this report centered on the jetting of concrete piles. R. H. Reid (N. Y. C.) favored the use of the jet whenever there was reason to believe that this would expedite the work. G. A. Mitchell (Grand Trunk) told of providing a pipe down the center of the pile for use in jetting in place of the independent jet pipe. He also favored the use of a heavy hammer weighing as much as 6,000 lb. A. B. Scowden (B. & O.) inquired as to the expense and trouble of cutting off concrete piles on which driving had to be discontinued before the anticipated cut-off level was reached. E. L. Sinclair (C. M. & St. P.) said that the answer to this was to determine the cut-off as accurately as possible by the driving of a test pile before the concrete piles were ordered. Mr. Mitchell said that this work was handled very readily by chipping away enough of the concrete to expose the reinforcing bars and then cutting them off

with a gas torch. E. K. Barrett (F. E. C.) said that he had used a riveting hammer fitted with a chipping tool very effectively for this purpose.

Closing Business

AT THE closing session the following officers are elected for the ensuing year: President, A. O. Ridgway, assistant chief engineer, D. & R. G. W., Denver, Colo.; first vice-president, J. S. Robinson, division engineer, C. & N. W., Chicago; second vice-president, J. P. Wood, supervisor of bridges and buildings, P. M., Saginaw, Mich.; third vice-president, C. W. Wright, master carpenter, Long Island Railroad, Jamaica, N. Y.; fourth vice-president, E. T. Howson, Editor, *Railway Maintenance Engineer,* Chicago; secretary-treasurer, C. A. Lichty, inspector, purchasing department C. & N. W., Chicago (re-elected); assistant secretary, F. E. Weise, engineering department, C. M. & St. P., Chicago (re-elected); directors for two years: S. T. Corey, assistant bridge engineer, C. R. I. & P., Chicago; W. B. Hotson, superintendent of bridges and buildings, E. J. & E., Joliet, Ill., and P. N. Nelson, supervisor of bridges and buildings, S. P., San Francisco, Cal.

Seattle was the unanimous choice as the location for the next convention, this city being chosen in recognition of the increasing use of western timber in bridge and building work and the importance of the members visiting this timber and studying its characteristics and production facilities at first hand.

The following subjects were selected for investigation and report at the next convention: (1) The repair and renewal of ballast deck trestles; (2) Water facilities at stock yards—their construction and maintenance; (3) Methods of installing or replacing sewers and pipe lines under traffic; (4) The heating of small passenger stations; (5) Tool equipment for bridge, building and water service maintenance gangs; (6) The relative merits of cast iron, concrete and corrugated metal pipe culverts; (7) The practicability of a uniform painting program for the entire year; (8) The supervision of bridge and building forces.

The Supply Exhibit

THIRTY-NINE dealers of materials and devices applicable to bridge and building work presented exhibit in a room adjoining the convention hall under the auspices of the Bridge and Building Supply Men's Association. The display attracted a great deal of interest and attention from those attending the convention.

The officers of the Supply Association for the past year were: President, M. J. Trees, Chicago Bridge & Iron Works, Chicago; vice-president, G. R. McVay, The Barrett Company, Chicago; treasurer, A. J. Filkins, Paul Dickinson Company, Chicago; secretary, D. J. Higgins, American Valve & Meter Company, Chicago; honorary director, C. E. Ward, U. S. Wind Engine & Pump Company, Batavia, Ill.; members of the executive committee: F. M. Condit, Fairbanks, Morse & Company, Chicago; W. H. Lawrence, Johns-Manville, Inc., New York; T. W. Snow, T. W. Snow Construction Company, Chicago; J. E. Nelson, Joseph E. Nelson & Sons, Chicago; William Volkhart, William Volkhart, Inc., New York, and B. J. Wilson, *Railway Maintenance Engineer,* Chicago.

The following give the names of the firms exhibiting, together with the names of their representatives and the nature of their exhibits:

American Tar Products Company, Chicago; J. D. Treadway.
American Valve & Meter Co., Cincinnati, Ohio; model of drop spout; J. T. McGarry, D. J. Higgins and C. F. Bastian.
American Hoist & Derrick Company, St. Paul, Minn; literature; W. B. Maurer.
Asphalt Block Pavement Company, Toledo, Ohio; asphalt flooring blocks and literature; E. J. Snyder.
Barrett Company, New York; roofing, shingles, specifications and literature; G. R. McVay and R. B. Gunter.
Chain Belt Company, Milwaukee, Wis.; literature on concrete mixers; C. H. Marsh.
Chicago Bridge & Iron Works, Chicago; photographs and literature; Merle J. Trees and Ced Smith.
Chicago Pneumatic Tool Company, Chicago; H. G. Barbee and T. G. Smallwood.
Cook, Inc., A. D., Lawrenceburg, Ind.; deep well equipment; Charles Taylor.
Detroit Graphite Company, Detroit, Mich.; samples of paint and literature; A. B. Edge and W. D. Waugh.
Duff Manufacturing Company, Pittsburgh, Pa.; jacks; E. A. Johnson.
DeVilbiss Manufacturing Company, Toledo, Ohio; paint sprayers; F. Craig.
Fairbanks, Morse & Co., Chicago; literature; A. A. Taylor, F. M. Condit, J. L. Jones, C. B. O'Neil and F. J. Lee.
Harker Manufacturing Company, Cincinnati, Ohio; fire prevention devices; C. E. Schultz.
Highgrade Manufacturing Company, Cleveland, Ohio; literature and samples of roofing cement; S. A. Baber.
Johns-Manville, Inc., New York; samples of roofing, pipe and boiler insulations, packing, shingles, waterproofing and industrial flooring; P. C. Jacobs, C. E. Murphy, Harry Newman, J. D. Johnson and W. H. Lawrence.
Joseph Dixon Crucible Company, Jersey City, N. J.; literature; H. A. Neally.
Lehon Company, The, Chicago; samples of roofing and shingles; Tom Lehon, John E. Eipper and F. T. Carpenter.
Long & Son, E. M., Cadiz, Ohio; model O. G. fir gutters; A. C. Long and H. D. Roby.
Massey Concrete Products Corporation, Chicago; literature; C. H. Hunsaker and D. A. Hultgren.
Minwax Company, The, New York; model of waterproofing, flashing bridge deck and literature; A. S. Harrison.
Mudge & Company, Chicago; literature; J. M. Mulholand and K. J. Eklund.
Murdock Manufacturing & Supply Company, Cincinnati, Ohio; hydrants and railway water service box; J. C. Endebrock and Kelso Murdock.
National Lead Company, New York; literature; F. M. Hartley, Jr., T. Mangan and S. V. Van Riper.
Nelson & Sons, Jos. E., Chicago; literature; I. B. Tanner.
Nichols & Bro., Geo. P., Chicago; literature; Geo. P. Nichols.
Norton, A. O., Inc., Boston, Mass.; literature on jacks and jack covers; G. R. Law.
Patterson & Co., W. W., Pittsburgh, Pa.; tackle blocks; W. W. Patterson, Jr.
Patterson-Sargent Company, Cleveland, Ohio; literature; G. W. Anderson and W. H. McBride.
Paul Dickinson, Inc., Chicago; model of cast-iron camp car jack, ventilators and chimney for small buildings; A. J. Filkins.
Railway Review, Chicago; copies of paper; W. M. Camp and L. E. Kohler.
Rivet Cutting Gun Company, Cincinnati, Ohio; rivet cutting gun and concrete digger; L. K. DeBus and Joseph Desalvo.
Robertson & Co., Wm., Chicago; model of culvert; R. F. Repasz.
Simmons-Boardman Publishing Company, New York; copies of papers; E. T. Howson, W. S. Lacher, F. C. Koch, B. J. Wilson and R. H. Smith.
Sherwin-Williams Company, Cleveland, Ohio; literature.
Snow Construction Company, T. W., Chicago; literature; T. W. Snow.
Stover Manufacturing & Engine Co., Freeport, Ill.; steel fence post and literature; W. V. Heckman.
U. S. Wind Engine & Pump Company, Batavia, Ill.; literature; C. E. Ward.
Volkhardt Company, Inc., The, New York; model of hydrants and parts; William Volkhardt.

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Some Comparative Costs of Laying Rail*

By George W. Morrow
Supervisor of Track, New York, New Haven & Hartford, New Haven, Conn.

In giving costs for laying rail every item should be considered, such as distributing the new rail and material, preparatory work, actual taking out of old rail, renewing turnouts, applying rail creepers and tie-plates and cleaning up of old material, i. e., old rail, angle bars, spikes, bolts, tie-plates, etc.

Where the same section of rail is being put in, and the tie-plates are in good condition the cost of renewing will be reduced considerably, as only two lines of spikes will have to be pulled and replaced and as the track will not have to be regaged throughout the whole stretch, and plates not disturbed, the labor cost of renewing rail will be at least 33 per cent less than if the whole operation had to be gone through. Before one railroad can compare the cost of renewals with another the above conditions should be taken into account.

The utilization of labor saving devices will effect large savings when a great amount of rail is to be renewed. Where traffic is light enough or where equipment can be delivered without serious delay, the use of labor saving equipment will bring down the cost on small stretches of track.

The unloading of new rail or loading up of the old rail by hand is a dangerous and costly practice. With equipment now on the market for doing this work, there is no excuse for doing the work in this manner. Some railroads use bridge and building derricks, steam ditchers, etc. These require an engineer and a fireman, also a watchman at night, and with some of them a work train would have to switch out a car as the cars were unloaded. The best device I know of is a double end rail unloader. With this machine two cars can be loaded or unloaded at a time, handling at the rate of five rails per minute. The machine is operated by air which it gets from the train line, and can be run by any intelligent laborer. If a great amount of rail is to be unloaded it will pay to put two or more machines in one train so as to save time switching out cars.

One method of putting in rail, is to set the rail on the end of the tie opposite where it is to go in and bolt it together, throwing in long strings of it on a day set for the purpose. This is an expensive way of doing the work, but in electric territories where heavy copper bonds have to be put in, it is about the only way that very much can be accomplished without delaying trains a great deal. In order to put rail in this way a gang of 30 men will set up about 300 rails in an eight-hour day. The rail is set on the ties and spiked on the quarters 8 to 10 in. from the running rail, bonded and bolted, using a small two-sided shim bent on a right angle. When setting rail up in this manner consideration must be given to expansion, more so than when setting rail in its permanent position, because on curves when the rail is thrown in its permanent place the rail on the outside of a curve will tighten, while the rail thrown in from the inside of a curve will open at the joints. To take care of this it is necessary to determine the degree of curves and leave openings at intervals. If only short stretches are put in at a time it is easy to watch this, but if a piece from one to eight miles long is set up in a single string and there are curves through the location, care must be taken so that the rail will not buckle when throwing in.

*A paper presented before the Metropolitan Track Supervisors' Club, New York, at its meeting June 10, and continued on October 14.

A gang of 275 men can put in about five miles of track in eight hours providing only two lines of spikes will have to be pulled and no tie-plates renewed or put in.

The cost will be approximately as follows:

Unloading new rail, material, etc.	$0.55 per ton
Setting up and preliminary work	1.55 per ton
Putting in new rail and taking out, old fully spiked and rail creepers applied	6.20 per ton
Picking up all old rail, scrap, etc., including unbolting of old rail	0.75 per ton
	$9.05 per ton

With the utilization of machinery the cost is reduced considerably and men are in better condition for the following day as the heavy duties are reduced. New rail and material are unloaded in the usual manner. Preliminary work, such as distributing material to points opposite where it goes, scoring ties in order to roll rail properly and in some cases pulling some of the crowded spikes, should be done with a small gang previous to the day that the rail is laid. The men should be organized and each gang given a certain duty to perform. On the day set aside to lay rail everything should be ready. Steam cranes should be near the point of the work with a supply of coal and water, the air compressors and accessories should be close by and in shape with supply of fuel at stations along the stretch where the rail is to be laid. A few minutes' delay means dollars when a large gang of men are held up.

The following is a line-up of men and gangs (for one rail) which has worked out well:

12 men pulling spikes
7 men throwing out old rail
12 men adzing, plugging and taking off old plates
4 men placing new plates on ties
10 men assisting hoist set new rail in and spiking same for hoist to pass over
9 men putting on angle bars and starting nuts on bolts
4 men running pneumatic nut-runners tightening bolts
45 men spiking complete
10 men tightening bolts behind nut-runners
5 men putting on rail anchors
12 men starting nuts off old bolts
4 men running pneumatic nut-runners taking off old bolts
12 men loading old rail, angle bars, scrap, etc., and cleaning up behind on a work train.

146 total.

The above organization is only one side and if men and machinery are available this line up should be doubled to take care of both rails at the same time while holding down a track. The above line up for one side includes a steam hoist, two tamping compressors, to run the pneumatic nut runners, two air, rail-loading machines, and a work train. In addition to the above, if territory is bonded for signal circuit, one more tamping machine should be added to each side for pneumatic air drills.

By using section gangs to assist in this work a number of foremen are available, thus giving better supervision and, as they have their own men, better results are secured.

The cost for doing work in this manner was as follows:

Unloading new rail, material, etc.	$0.55 per ton
Preliminary work, scoring ties, distributing material, pulling every other spike, etc.	0.28 per ton
Putting in the rail, which included the whole operation and also included cost of engineers, fuel, etc., cleaning up and picking up the old rail and signal department work, drilling and bonding...	3.80 per ton
	$4.63 per ton

On a test stretch of three miles, rail was laid at a cost

of $1.55 per ton, or $260.40 per mile, which included loading all the old material, but there were no delays as the machinery worked every minute and at times rail was laid and completed at the rate of one rail every 25 seconds.

Labor Board Grants Two Cent Increase

ON OCTOBER 14, after a delay of more than ten days, the United States Railroad Labor Board announced a decision in the wage case involving the railroads and the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers. In brief, this decision provides for an increase of two cents per hour to track men and a few other classes of employees, but no increase for bridge and building forces and other skilled trades. The decision was made effective as of October 16. According to the board the increase applies to 451,911 maintenance of way employees and will add approximately $22,125,000 to the railroads' annual payroll.

The specific provisions of the board's decision authorize the increases for certain classes of employees to be effective on carriers whose names are specifically mentioned as parties to the case. The schedule of increases is as follows:

"Sec. 1. Bridge, building, painter, construction, mason and concrete, water supply and plumber foremen (except water supply and plumber foremen coming under the provisions of section 1 of Article IV, Decision No. 147).....No increase

"Sec. 2. Assistant bridge, building, painter, construction, mason and concrete, water supply and plumber foremen, and for coal wharf, coal chute and fence gang foremen, pile driver, ditching and hoisting engineers and bridge inspectors (except assistant water supply and plumber foremen coming under the provisions of section 1 of Article IV, Decision No. 147).....No increase

"Sec. 3. Section, track and maintenance foremen and assistant section, track and maintenance foremen.....2 cents

"Sec. 4. Mechanics in the maintenance of way and bridge and building departments (except those that come within the scope of agreements with the Federated Shop Crafts).No increase

"Sec. 5. Mechanics' helpers in the maintenance of way and bridge and building departments (except those that come within the scope of agreements with the Federated Shop Crafts).....No increase

"Sec. 6. Track laborers, and all common laborers in the maintenance of way departments and in and around shops and roundhouses not otherwise provided for herein.....2 cents

"Sec. 7. Drawbridge tenders and assistants, pile driver, ditching and hoisting firemen, pumper engineers and pumpers, crossing watchmen or flagmen, and lamp lighters and tenders....2 cents

"Sec. 8. Laborers employed in and around shops and roundhouses, such as engine watchmen and wipers, fire builders, ash pit men, flue borers, coal passers (except those coming under the provisions of section 3 of Article VIII, Decision No. 147), coal chute men, etc.....2 cents

"Sec. 9. For miscellaneous classes of foremen and other employees named in connection with a carrier affected by this decision, but not specifically listed under any section in the classified schedules of increases, add an amount equal to the increases specified for the respective classes to which the miscellaneous classes herein referred to are analogous."

"Sec. 2. Increases specified in this decision are to be increased on the following basis:

(a) For employees paid by the hour, add the hourly increase to the hourly rate.

(b) For employees paid by the day, add eight times the hourly increase to the daily rate.

(c) For employees paid by the month, add 204 times the hourly increase to the monthly rate.

Basis for the Decision

It is interesting to note that the Labor Board felt called upon to present a reason for modifying its previous decision with respect to a given class of employees after a lapse of only 3½ months. The justification given is the "sharp upturn of wages which began in April of this year in various industries, affecting particularly common labor." This statement was supported by various data including a review of the wage advances of the United States Steel Corporation during the past season.

The board also commented on the minimum rate of 25 cents an hour for common laborers and track men prevailing in certain restricted territories and pointed out that the territorial differentials established in 1918 have not yet been disturbed by any of the decisions of the Labor Board and are not changed by the present decision.

Dissenting Opinions

Mr. Wharton's objection to the decision of the majority of the board hinged largely on the question of the living wage which played such a large part in the statement made before the board in the course of the hearing of this case, it being the contention that the board recognized this principle as a prime consideration in arriving at its decision.

In objecting to the minimum rate of 25 cents an hour established by the decision for certain parts of the country, Mr. Wharton called attention to the fact that the annual full time wage on this basis is only $612 or $51 per month. He also called attention to the fact that the New York, New Haven & Hartford, in negotiating an agreement with an organization other than the Maintenance of Way Brotherhood, established a rate of 40 cents per hour for track men.

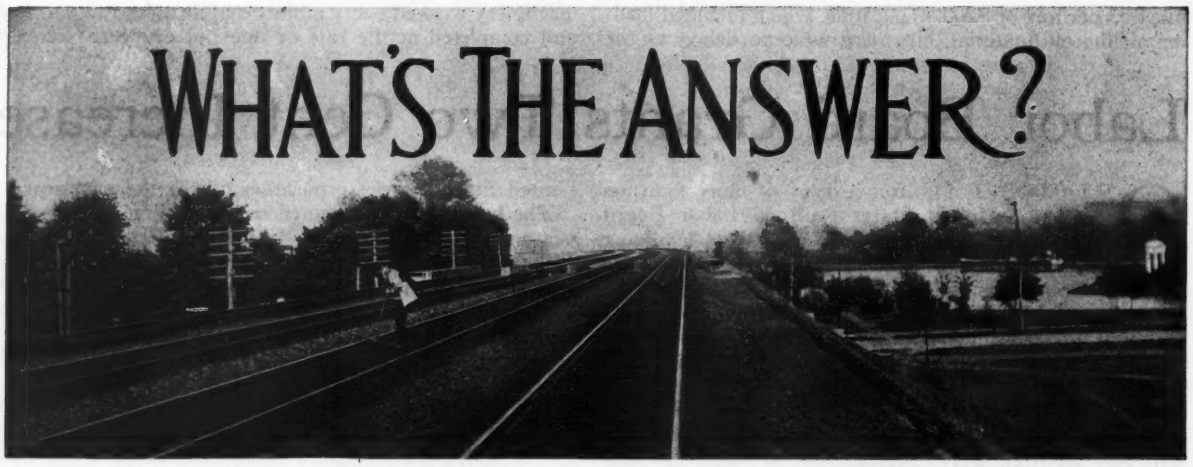
The report also contained an appended statement by W. L. McMenimen, a member of the labor group, who voted with the majority in arriving at its present decision. Mr. McMenimen expressed the opinion that the wage advance granted was not adequate. However, as the increase of two cents per hour is equivalent to approximately $70,000 per day to the total number of employees involved, they suffered a serious loss for every day that the decision was delayed and a failure to reach a decision would not only further augment this loss in earnings, but might have resulted in failure to obtain an increase.

Supporting Opinion

In answer to the dissenting opinion by Mr. Wharton, the majority members of the board issued a supporting opinion, the purport of which was to show that the decision of the board was in accordance with the terms of the Transportation Act. Among other things, it outlined the factors named in the statute which the board is bound to consider in establishing wage rates. These are as follows: (1) The scales of wages paid for similar kinds of work in other industries. (2) The relation between wages and the cost of living. (3) The hazards of the employment. (4) The training and skill required. (5) The degree of responsibility. (6) The character and regularity of the employment. (7) Inequalities of increases in wages or of treatment, the result of previous wage orders or adjustments.

The statement contends that the dissenting opinion summarily excluded the first of these factors and argues that it should receive no consideration. The statement also shows that to increase the rates to 72 cents an hour for common labor, in accordance with the assumed living wage, with corresponding differentials for the skilled classes of labor, would add approximately $3,100,000,000 to the annual payroll and would have the result of making the expenses of the railroads more than $2,200,000,000 greater than are the revenues upon which they must depend.

WHAT'S THE ANSWER?



This department is an open forum for the discussion of practical problems of maintenance of way and structures. Readers are urged to send in any questions which arise in their work in the maintenance of tracks, bridges, buildings and water service. The *Railway Maintenance Engineer* also solicits the co-operation of its readers in answering any of the questions listed below.

The following questions will be answered in next month's issue:

(1) *Should switch ties be stocked, distributed and renewed in sets or singly?*
(2) *What can be done to overcome pounding of the outlet valve in a roadside tank when closed?*
(3) *What is blue stain in lumber? Is it harmful?*
(4) *What are the requirements of a good broom for use in sweeping snow from switches?*
(5) *What is the best method of banking buildings during the winter in cold climates?*
(6) *In general, how far should the intake end of a suction line of a pump be submerged below the surface of the water to avoid surging or air sucking?*
(7) *How may the cracking noise in steam heating coils be avoided?*
(8) *At what elevation above the ground water level is it safe to cut off untreated piles without fear of decay?*

Lining Spikes on Trestles

Is it advisable to allow boat spikes used on open deck trestles to protrude above the ties, considering the danger to pedestrians, and if so, why?

First Answer

We do not use spikes, driven in this way, for fastening ties in place on the stringers, and I do not believe they are advisable, as trainmen, especially at night, are liable to catch their feet on the spikes and be thrown off the bridge or suffer injury otherwise.

We do not fasten the ties in place on wooden bridges except with wooden guard rails, placed along the ends of the ties, parallel with the rail, and framed down over the ties, to prevent them bunching, in case of derailment. This method has been found very effective and satisfactory, and I consider it much better than the use of boat spikes, with the heads protruding above the top of the ties.

R. H. REID,
Supervisor of Bridges, New York Central, Cleveland, O.

Second Answer

Boat spikes driven between the track rail and the outside guard rail of pile bridges for lining purposes are allowed to stick up above the ties in order to facilitate their removal and to avoid the injury that results to the ties where it becomes necessary when drawing the spike to cut into the tie.

In the 30 years in which I have had experience in building and maintaining pile bridges, the great majority of which were open deck, and for which the lining spikes placed between the rail and the outside guard rail were allowed to protrude one inch above the ties, I cannot recall a single case where either a workman or a pedestrian has been injured by or through them. The workmen know where they are and look out for themselves, and a pedestrian crossing the bridge would have to be of a perverse mind if he choose the narrow strip between the rail and guard rail to walk in when he can walk with more comfort in the middle of the track where there is nothing in his way.

A. YAPPEN,
Assistant Engineer, Chicago, Milwaukee & St. Paul, Chicago.

The Relative Advantages of Hewn and Sawed Ties

Are hewn ties or sawed ties to be preferred? Why?

First Answer

Hewn cross-ties are superior to sawed ties in the following respects:

(1) They offer greater resistance against movement through the ballast and for that reason make better joint or intermediate ties against which rail anchors may be placed. (2) They are usually cut from small, live timber and make a good sound tie with a minimum amount of sapwood and frequently last longer in service than a sawed tie of same kind of timber.

Sawed ties have the following advantages: They are of uniform width and thickness and are easier to handle and use in the construction of new tracks. They are also easier to apply for renewals, especially where they

replace a sawed tie of the same dimensions. Hewn ties are not uniform in width and thickness, as a result of which more work is involved in using them for renewals, it frequently being necessary to take out or disturb the old bed and respace the adjacent ties. W. H. PENFIELD,
Engineer Maintenance of Way, Chicago, Milwaukee & St. Paul, Chicago.

Second Answer

Sawed ties are preferred because hewed ties usually have sapwood on one or more sides and the faces are not always plane surfaces as in sawed ties. I am in favor of sawed ties especially because of their regularity in dimensions. The rails will always find a better bearing on sawed ties, which makes the track easier to maintain.

A. L. CAMPBELL,
Roadmaster's Assistant, Southern Pacific, Sacramento, Cal.

Third Answer

Well manufactured hewed ties have no inherent superiority over well manufactured sawed ties, or vice versa, provided the wood in each is alike as to kind, character, and quality; but the customary conditions under which cross-ties are produced give to sawed ties the following advantages over hewed ties: (1) They are nearer the required dimensions. (2) They are inspected more rapidly. (3) They are safer to handle (less splinters). (4) They stack better. (5) They require less adzing, if any, for plate or rail. (6) Usually they decay less rapidly because they usually have less sapwood than hewed ties. (7) They cost less for handling, hauling, freight, storage, distribution, and insertion in track, and for preservative if treated. Hewed round ties of all the standard sizes have an average volume 20 per cent greater than these sizes of sawed rectangular ties.

The greater durability, generall, of the old-time shingle compared to the modern one provides the basis for the belief that the splitting along the fibres which occurs when wood is rived is superior as a method of manufacture to the severing of the fibres which occurs when wood is hewed or sawed, and this idea about shingles has been carried into the consideration of the relative merits of hewed and sawed ties, though the service demands made on these two forms of forest products are not comparable. The impression that hewed ties should be superior to sawed ties was strengthened by observation of the comparatively rapid deterioration of ties sawed from brashy butt logs of large old trees or the knotty centers of trees, remaining after the better cuts were made into products higher priced than ties.

Hewed ties are generally cut from younger and more virile trees than those whose logs are sawed, a hewer leaving in the woods a poor stick difficult to shape, but of the same quality as that from which a sawer will cut a tie with little physical exertion, and thus salvage the costs of skidding and hauling the log to the mill. Consequently the quality of a sawed tie is sometimes such that it should not be accepted for roadway service, and its subsequent failure in track is attributed to the method of its manufacture instead of to the real cause, the quality of the wood.

The pith of hewed ties is more apt to be centered (boxed) than in sawed ties, and unfortunately maintenance men are not always careful when using sawed ties to place upwards in track the horizontal surface having the narrower strip of heartwood, so that the more rapid decay and more extensive splitting than would occur in properly laid sawed ties is also charged against the method of manufacture instead of against the actual cause, the improper use of the ties.

The supposition that hewed ties are superior to sawed ties is also based on the surmise that an axe closes the pores of the wood severed by it, while a saw does not, from which the belief springs that the hewed surfaces resist the ingress of water more than sawed surfaces can. It is also believed that the rough surface left by a saw holds moisture, while a smooth hewed surface does not. Both conjectures are cited as reasons why sawed ties decay more rapidly than hewed ties. Since hewing closes no more wood vessels than sawing does, there is no foundation to the first claim. The second also is fallacious, since the score-marks and other depressions in the uneven surface of a hewed tie provide more receptacles for retaining moisture than the saw fuzz does.

JOHN FOLEY,
Forester, Pennsylvania System, Philadelphia.

Testing Pipe Lines

To what extent should a newly-laid pipe line or a line subjected to extensive repairs be tested before back filling, and what is a good way of making such a test?

Broadly speaking, every joint in a pipe line should be tested to the maximum allowable pressure of the pipe at the time the joint is made. This is not always practicable, however, and it is frequently necessary to trust to the skill and integrity of the workman; and to his credit, let it be said, the confidence is seldom abused.

There are other elements entering into the construction of pipe joints together with the possibility of cracked or damaged pipe that may be overlooked in laying, that make it very desirable to test the line before back filling, and where this can be done the pipe should be tested in sections of 1,000 ft. or so by either air or water pressure. The pressure during the test should be higher than that which will be obtained in regular service. All openings in the pipe must be closed and a gage applied. Where water pressure is used for testing a small water meter should be connected to the line to determine the exact leakage. As a new line is seldom "bottle tight" slight drips may be expected to "make up" at the joints unless a defect exists. The use of a meter is especially valuable in testing lines after they have been back filled. C. R. KNOWLES,
Superintendent of Water Supply, Illinois Central, Chicago.

The Proper Storage of Coal

What precautions should be taken in stocking coal bins to protect the coal from slaking and at the same time avoid spontaneous combustion?

I feel safe in saying that the above question is given little thought by the average supervisor, and I doubt if very much by the higher officials when arrangements are made to equip stations, pumping plants and other railway buildings with the necessary space and facilities for holding coal. This arises, no doubt, from the fact that the amount stored is small, ranging from possibly ten tons to a carload, depending largely on the size of the structure and the purpose for which it is to be used. Furthermore, it is usually unloaded by the track forces whom the track supervisor prefers to have work on the track. Therefore, the smallest amount possible is usually unloaded at one time. Also it is not good practice or economy to store more at a small station at one time than is required for the winter's use, not only because of the money invested, but because of the deterioration in value by slaking which usually takes place.

This leads us to inquire into the causes of slaking. It is well known how quickly lime dissolves when water is poured upon it or how quickly it slakes where damp. Dampness has the same effect upon coal if left exposed long enough. If stored in a bin outside the building the bottom should be well above the ground and so con-

structed that a good circulation of air can be obtained so that the bottom of the bin and the ground will dry quickly after a storm, preventing dampness entering from the bottom. The roof, sides and floor should be so constructed that water cannot get through, with special attention given the roof. Where coal is stored in a properly constructed bin outside the station there is little danger of spontaneous combustion. If stored in a bin inside the building a double floor should be provided with tar paper between the layers. Cover the top and sides with matched lumber. For basement storage raise the floor at least 4 in. above the basement floor.

As coal is composed principally of carbon, before spontaneous combustion can take place it is necessary that a certain amount of oxygen from the air combine with it. If the action is rapid enough, the heat becomes so intense that combustion takes place; thus we see how necessary it is to construct coal bins so as to guard against this. It may be necessary to place a false partition against a basement wall to allow free circulation of air if much coal is to be stored, or to place gas pipes in the bin at various points. Wooden standards placed in such positions that the coal does not form compactly about them can be used to advantage. Also keep the bin dark as much as possible, as a light has a bearing both on slaking and combustion. JOHN P. WOOD,

Supervisor of Bridges and Buildings, Pere Marquette, Saginaw, Mich.

The Effect of Cement Dust on Health

Is it injurious to health for one to handle cement or remain long in an atmosphere of cement dust without using some sort of protector?

First Answer

There has never been any complaint from this source made to our general foreman in charge of this work, although he has men who have been continuously at such work for periods of from 10 to 22 years. My conclusions are that it is not injurious to the health where the cement is handled in the outer air, although it probably would be if the work was confined. Under such conditions it would probably be advisable for the worker to wear some sort of protector. In outside work only a comparatively small amount of cement dust would be swallowed or breathed into the lungs and there is, ordinarily, enough free acid (hydrochloric) in the stomach to dissolve it.

M. HIRSCHTHAL,

Concrete Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

Second Answer

Although the general statement is made that exposure to mineral dust has injurious effects upon health which reveal themselves in a higher death rate, cement dust seems to be the exception which proves the rule.

Summarizing various reports of investigations conducted by the medical profession and accident and health inspection officers, it may be stated that, because of its lime content, cement is an effective germicide and that because of its extreme fineness and absence of grit, it is non-irritating. As a matter of fact, quite frequently workmen get cement dust in their eyes, but seldom are the eyes infected. Also, where men have been cut and cement ground in the wound, such wounds heal just as clean as if they were free of cement dust.

No doubt men working in cement mills, and especially in packing rooms where they are constantly breathing cement-dust-laden air, get some dust in their breathing organs, yet it is quite conclusively proved by long years of experience that employees in the cement industry seem almost immune from serious pulmonary trouble. Checks have been made time and time again on workmen individually and collectively, many of whom have worked continually in the most dusty parts of mills for upwards of ten or more years, with results showing that the run of health of men in such occupations is as good as of those employed in dustless work.

In our own company employing about 2,400 men in the mills at Pittsburgh, Chicago and Duluth, we are aware of only one mortality case during the 28 years in which we have been operating which could possibly be attributed to tuberculosis, or consumption as it is generally called. This was the case of a man who died in 1905, after having been employed about 10 years first as a mechanic and later as foreman of a mill. This particular case was clearly traceable to the individual not taking proper care of his health and as a consequence he died from the effects of cold contracted from exposure in cold weather.

Workmen in cement plants seldom wear protectors over their noses, although occasionally men tie handkerchiefs over their noses when they are doing exceptionally dusty work. J. W. LOWELL,

Assistant Manager Service Bureau, Universal Portland Cement Co., Chicago.

The Use of Anti-Creepers on Bridges

Is it good practice to use anti-creepers on bridges, especially those of some length?

First Answer

It is considered good practice to use anti-creepers on bridges providing the approaches thereto are anchored in full and providing, also, that enough anti-creepers are applied within the bridge limits to effect the complete anchoring of each rail. On the Great Northern we have been proceeding on this bases for several years with satisfactory results. Anti-creepers have been applied to trestles upwards of a half mile in length, where under normal conditions track has crept badly and in all cases the creeping was stopped. J. R. W. DAVIS,

Engineer Maintenance of Way, Great Northern, St. Paul.

Second Answer

The use of anti-creepers is justified on bridges, especially those of some length, to hold the rail in position and not allow open joints at the end of the structure. While, in the case of steel bridges elaborate provisions are made for the expansion of the steel which might be affected by the placing of anti-creepers on the rail, the fact that the anchors are not attached rigidly to the ties prevents them from interfering with this expansion. I. F. STERN,

Consulting Engineer, Chicago.

Third Answer

On bridges the policy best to follow is not to slot spike the joints or apply anti-creepers. Where the rail is running it meets with greater resistance on a bridge than it would on ballasted track and an attempt to fix the bridge rigidly would tend to cause the rail to buckle on each end. Moreover, if anti-creepers are applied upon the bridge they will cause additional strain upon the bridge ties, causing them to split in the process of slewing and greatly affect the line on the bridge. G. E. STEWART,

Assistant Engineer, Southern Pacific, Stockton, Cal.

Fourth Answer

On our Ohio River bridge, which is 3,932 ft. long, we installed anti-creepers in 1909, when the old bridge was removed and the present structure erected. The anti-creepers were installed four to the rail, as our heavy loaded movement is towards the north, and the creeping was in

that direction. A steel block was bolted to the steel stringer to hold each of the ties where an anchor was installed. This system of anchoring has caused us absolutely no trouble up to the present time and our rail has been practically stationary on this bridge.

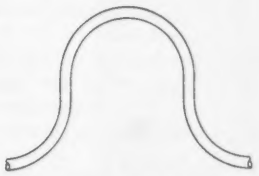
The ties on this bridge are 8 by 10—12 ft. white oak, spaced 12 in. center to center, and we have an outside guard rail of 6 by 8 fir. The rail over the bridge is 90-lb. A. S. C. E. and it is tie plated throughout with a 7 by 9 plate. We also have an inside guard of 70-lb. A. S. C. E. rail, installed in 1913. The south approach to the bridge is on a three-tenths of one per cent (.3 of 1%) grade, and the north approach is on a five-tenths of one per cent (.5 of 1%) grade, the channel span of the bridge being set level.

C. M. McVAY,
Division Engineer, New York Central Lines,
Charleston, W. Va.

Providing for Expansion and Contraction of Hot Water and Steam Pipes in Engine Houses

How can expansion and contraction be taken care of best when installing hot water and steam lines in engine houses, etc.?

Hot water lines in engine houses should be laid out to conform to the curvature of the house, and should be supported from the roof by fairly long pipe hangers, with



An Expansion Bend

one anchor centrally located. This has been found to provide sufficiently for expansion and contraction.

Like hot water lines, steam lines should also conform to the curvature of the house and be supported by fairly long hangers, but on account of the high temperatures, expansion bends should be placed about every 200 ft. with an anchor midway between these bends. Expansion bends are preferable to expansion joints on account of the lower costs of maintenance. They should have as large a radius as is practicable and in no case less than five diameters of the pipe.

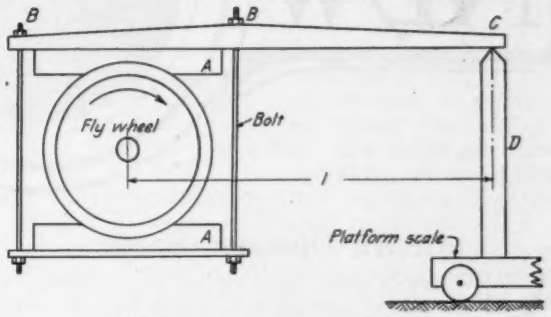
C. C. CAMPBELL,
Assistant Engineer, Mechanical Department, New York Central, New York.

How to Find Out How Much More Load a Power Unit Will Stand

In cases where it is desired to place an additional load upon the power unit, as by installing a larger or an additional pump, how may one determine preparatory to making the change just what additional load the power unit will stand?

The Prony brake furnishes the most practical method of making such a finding. This method consists of attaching a friction brake to the fly wheel or pulley so that the force on the brake may be transmitted to and read upon a platform scale. A simple form of such a brake is shown in the figure, where AA represents two bearing blocks which bear against the face of the pulley or fly wheel; B-C is a beam, one end of which is supported on a post, D, which rests on the platform of a weighing scale, and where B-B are nuts by means of which the friction blocks may be tightened against the fly wheel. In actual practice this brake is often made by using a single band of iron in place of friction blocks, so that tightening can be done by means of one bolt.

Suppose it is desired to operate an additional pump with this power unit, which for the purpose of illustration will be considered a gas engine. The brake is placed over the fly wheel in such a position that when tightened the end



A Simple Form of Prony Brake

of the beam will bear down on the platform scale. With the brake in position but not yet tightened in place, a reading is taken on the scale to determine the weight of the brake under no load. At the same time a measurement is taken of the horizontal distance from the hub of the fly wheel to the point at which the beam bears down upon the platform scale. The engine is then set in operation, and all machinery set in motion, after which the adjusting nuts in the brake are gradually tightened until a point is reached beyond which the engine will slow down under the load, when a second reading is made on the scale.

The measurements having been taken, let S be the reading on the scale when the brake is under no load; W, the reading on the scale just before the brake begins to slow down the fly wheel; a, the horizontal distance from the support C to the center of the fly wheel shaft, and n, the number of revolutions the fly wheel makes per minute. The additional horsepower available in the power unit is then determined as follows: Horsepower equals $0.000190\ (W - S)\ a\ n$.

If this figure is larger than the horsepower required to operate an additional pump obviously the pump may be installed, otherwise not. In case it is not known how much horsepower the additional pump will require but where this pump is the same size as the pump in use, the problem resolves itself simply in making a brake test of the engine when running free, followed by a brake test under load. Then without making any calculations, if the scale reading with the engine running free is more than double the scale reading when under load, the engine will take an additional pump of the same size.

SAFETY MEN DISCUSS CROSSING RULES.—A number of railway safety representatives recently men with the Illinois Commerce Commission to discuss nine proposed grade crossing rules, pursuant to an invitation from the commission for suggestions prior to putting the rules into effect. The commission has designated crossings a hazardous and has formulated rules for the erection of suitable signals. These rules also provide for the removal of obstructions, the leveling of approaches and the elimination of growing crops on the right-of-way which may obstruct the view of the crossing. In general, the new rules were approved by the railroad representatives.

NEW DEVICES

An Air-Operated Spader

A NEW device which probably has no precedent thus far in railway service, and whose introduction in this field of enterprise affords an interesting subject of reflection, particularly on the part of those having jurisdiction over work involving various kinds of excavating by hand methods, is a pneumatic operated spader, a tool which consists essentially of an air hammer fitted with a small spade.

Since its development, the spade has been used mainly in driving tunnels in soft ground where heavy clay is encountered, but it is also reported to have shown marked adaptability in excavating stiff clay in trenches, open cuts and caisson work where the ground is not sufficiently hard to be drilled and shot but too hard to be handled readily by ordinary pick and shovel. The device thus represents itself as a means of supplanting the hand pick and shovel in places where these tools are not altogether satisfactory.

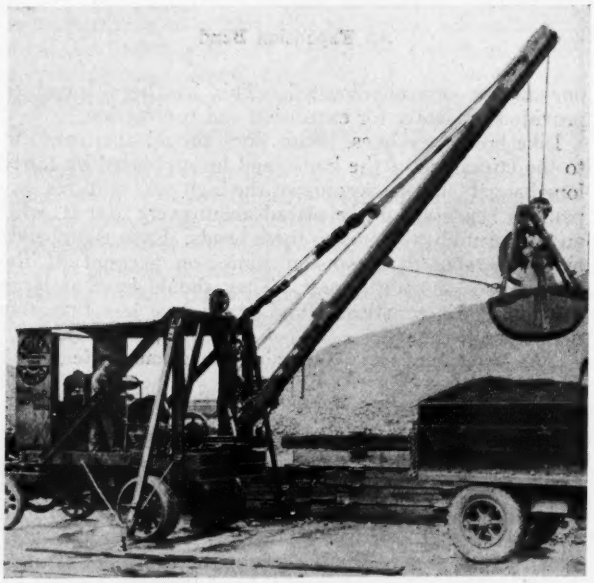
The Sullivan Spader Assembled for Use

Specifically, the spader consists of a cylinder, on one end of which is bolted the handle and at the other a special retainer for holding the steel spade in the nose or chuck of the hammer. This hammer is 17 in. long, takes ½-in. air hose, weighs 16 lb. and is operated by means of a thumb throttle placed at the top of the handle grip, where its action will not be hindered by an accumulation of mud or grit. Digging tools other than spades may be employed if desired. The standard sizes for the spades are 4-in., 5-in. or 6-in. in width. They are made of materials capable of withstanding the shock of the air piston without breaking or chipping at the shank end. The spader strikes a hard, quick blow and will do satisfactory work at air pressures between 45 lb. and 100 lb., although a higher range of pressure is recommended in particularly stiff ground. The device is well balanced and free from a degree of vibration causing difficulty in handling.

As an example of the performance of these spades, a report is made that in tunneling blue glacier clay of a very hard and dry quality in a Chicago district, the spades increased the former output of from three to four yards in an eight-hour shift to from eight to ten yards. The device is a product of the Sullivan Machinery Company and is known as the Sullivan spader, class of "D. E.—361."

A Demountable Truck Crane

ONE OF THE newest developments in portable cranes is a demountable crane unit that may be installed on any motor truck capable of supporting the weight of the crane unit, which is six tons. For railway use it would generally be found advantageous to mount this crane on a push car of suitable dimensions or on a motor car designed for the purpose. Thus a convenient and portable hoisting equipment would be provided for conditions where the service would not justify the expense for a locomotive crane. This crane unit is known as the Byers Truckcrane, and is manufactured by the Byers Machine Company of Ravenna, Ohio. It is similar in every way to the Byers Auto Crane Model No. 1, except that it has no wheels, jack shaft, differential or drive chain. As shown in the photograph the crane is furnished with a Hercules four-cylinder, 4-in. by 5-in. gasoline engine capable of developing 30 hp. The hoisting equipment is designed to handle clamshell buckets weighing not over 2,000 lb. and also has a drum for raising and lowering



The Crane as Mounted on a Motor Truck

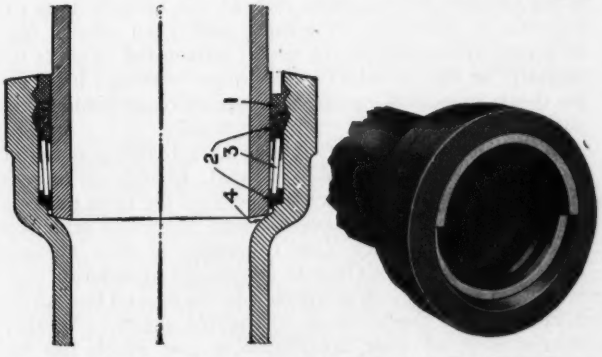
the boom. Outrigger struts are provided for increased stability and to relieve the truck or car on which the crane is mounted of a considerable portion of the lifting stresses.

Cast Iron Pipe With Pre-Calked Joints

A PRE-CALKED joint has been developed for cast iron pipe by the McWane Cast Iron Pipe Company, Birmingham, Ala., which transfers most of the difficult and laborious work of preparing the joint from the trench to the plant of the manufacturer. This is accomplished, however, without any radical departure from the form of bell and spigot joint which have been so long the standard in cast iron pipe practice. The process of laying the pipes in the trench is conducted in the ordinary way, but owing to the fact that the packing of the joint is already in place it is only necessary to calk the top half of the joint and touch up the bottom lightly to obtain a tight joint.

Pre-Calked Pipe in a Narrow Ditch

The joint packing is applied to the bell end of the pipe at the plant, while the pipe is placed in a vertical position. A mandrel imperceptibly larger than the spigot end of the pipe is inserted in the joint. Then braided hemp packing, a specially-prepared ring of close-set iron wedges, two more braids of hemp, and a final filling of lead are placed in the joint. Pneumatic calking tools calk the joint thoroughly for one-half its circumference. The mandrel is then removed and the packing

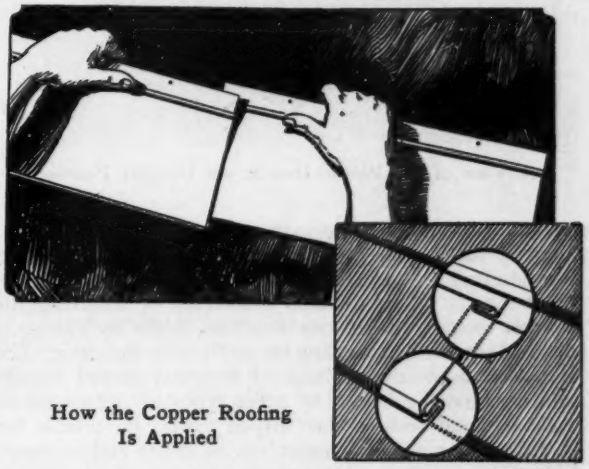


A Section and an Elevation of the Joint. 1, Lead; 2, Hemp Packing; 3, Iron Wedges; 4, Shoulder of the Pipe

of the joints remains securely in place ready for the insertion of the spigot end of the pipe when the pipe line is being laid in the ditch. To protect the joint for shipment in handling the packing is guarded by a wooden block, which is removed after the pipe has been placed in the trench. In laying this pipe it is placed with the pre-calked side downward and calked on top. Driving the lead in at the top forces the pipe down firmly to a seat at the bottom. A little touching up of the bottom side of the joint with double offset tools completes the work.

New Designs of Copper and Zinc Roofing Shingles

THE ADAPTATION of copper and zinc in a simplified form for roofing purposes has been carried out recently by the Anaconda Copper Company, New York, through the manufacture of interlocking shingles made from these metals. The shingles are made of pure copper and zinc of a size to give an exposure when laid of 8 in. by 18 in. or one square foot. The weight per square (100 sq. ft.) is 84 lb. The interlocking feature of these metal shingles is secured by either turning the edges over or under so as to engage with the turned over edges of the adjoining shingles. The roofing is laid from the eaves toward the ridge and is fastened down by copper, nailing the upper edge, which is covered in turn by the next shingle. A wide variety of special pieces of standardized



How the Copper Roofing Is Applied

dimensions have also been manufactured for use at the eaves, in valleys, at the verge and ridge, etc. Besides the natural copper finish, the shingles have been put out in seven colors, rendered permanent by a special electrical process. The shingles can be laid over old wooden roofing. For obtaining a fireproof roof structure, various types of construction have been developed utilizing gypsum or special composition blocks carried on metal. The shingles are nailed directly to the gypsum or composition blocks.

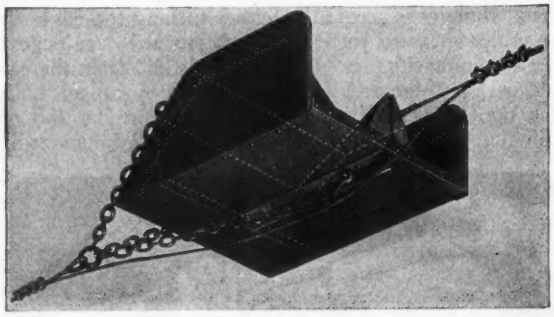
An Improved Drag Line Scraper

THE MANY situations which arise in railway service at present suggesting or compelling the storing or reclaiming of coal, earth or other bulk materials in large quantities, have operated to make drag line scraping deserving of quite as much attention in maintenance work as it is in construction. In view of this it is of interest to note a recent development which has been made in drag scraper design.

As the illustration shows, the scraper in question embodies a design quite the reverse of the usual drag scraper; what would ordinarily be taken as the pan or bottom of the bucket serves as a top plate in this case, with the tapered end of the scraper acting as the back end instead of the front end or cutting edge. According to the ordi-

nary use of words, the bucket thus more nearly resembles a hoe than a scoop and doubtless for this reason is called a power hoe rather than a drag scraper. Constructed along this line, the sides serve not only as sides but as runners upon which the scraper is dragged over the material being handled and the top plate serves to prevent any overloading of the scraper by reason of the digging into the mass by the cutting edge greater than that required to fill the scraper to capacity. As shown by the dotted lines, the cutting edge in question is so shaped as to serve as a scraper during the forward motion of the hoe and to keep the scraper on top of the material when being dragged backward.

For use, the scraper is connected to a steel cable, the ends of which are fastened to driving drums on the power unit and it is operated by drawing the scraper to and fro



A View of the Power Hoe in the Upright Position

over the storage pile, the path of the scraper being regulated by passing the cable around sheaves located whereever desired in the storage yard. Under this arrangement the storing of material is effected by attaching the scraper to the cable in one direction, while reclaiming is effected merely by reversing its position on the cable. The scraper is applicable to large or irregular shaped storage which cannot be served by other types of equipment as well as small and regular shaped areas; is suitable for storing either in buildings or out of doors and is represented as an unusually economical form of equipment. The hoe is a product of the Link-Belt Company, Chicago.

Zinc as a Building Material

NEARLY every man when he hears the word "zinc" recalls the sheet of gray metal that lay on the floor under his mother's kitchen stove. Until recently zinc has been a well-known but little used metal. It is only within the last year or two that its use has been widely extended primarily as a building material. Few people in this country realize that zinc has long had wide application in Europe for roofs, gutters and down spouts, some installations being over one hundred years old. Even more surprising to the average man is the fact that there is a zinc roof on a station of the Erie railroad at Masthop, Pa., that has been in service for 37 years.

There are several reasons why zinc is adaptable to building uses, particularly in roofs, gutters, corrugated siding, down spouts, weather strips, etc. It does not corrode or rust like iron or steel. It is cheaper than any of the other non-ferrous metals. Zinc, as cast into ingots, is known as spelter. This is rolled into long strips, called strip zinc or into large sheets (rolled in two directions) known as sheet zinc. Sheet zinc and strip zinc are the two basic forms from which practically all other pure zinc products are produced.

The properties of zinc are of interest particularly because of the fact that its strength is not entirely out of proportion to that of rolled iron or steel. The ultimate strength of zinc in tension is about 21,000 lb. per sq. in. Its strength in shear is about 30 per cent of that of soft steel. Its ductility is considerably less than that of soft steel and varies to an appreciable extent with the direction of the grain as obtained by the process of rolling. Zinc melts at 419 deg. C. and boils at 950 deg. C. The strength of zinc coupled with its durability adapts it for locations where corrosion militates against the use of steel. Zinc oxidizes on exposure to the elements with the effect of giving it a coating of a silver gray color that is not only pleasing in appearance, but serves as an effective protection to the metal underneath. The considerations of appearance and protection being thus fulfilled, there is usually no need of painting zinc. This saving in the cost of paint will in some cases make the zinc as cheap as steel, particularly for corrugated roofing and siding for building where the first painting and subsequent repainting so necessary for steel roofing and siding comprise an important element in the cost.

These characteristics of zinc have led to its recognition as a building covering by a number of the railroads. The largest installation is that on the new Erie pier at Weehawken, which will be covered completely with this material. A total of 35,000 lb. of zinc will be used for the cornice alone. It has also been specified as a covering for coaling station structures by the Illinois Central, the Burlington, the North Western, the Chicago, Great Western, the Central of Georgia and other roads.

All structural materials have their own peculiarities and with those in common use, these are so well understood that the special requirements of workmanship to which they give rise are met readily by the workmen of the trade with practically no attention on the part of those responsible for the work. Zinc has two properties which require the observance of certain precautions in its use and which require mention here because of its comparatively recent application to building purposes. Zinc has a coefficient of expansion 2.6 times that of steel, therefore it must be applied in a manner that allows adequately for the change in the size of the sheets or strips with changes in temperature.

In a saline or acid bath, zinc is electro-positive to all of the commoner metals. That is, it is dissolved where it comes in contact with them. This fact is of importance only where the contact of zinc with other metals is subject to the presence of moisture, such as rain water. It is of importance, therefore, in gutters and down spouts, but by proper precaution in the use of galvanized hangers or supports or the introduction of proper coatings between the down spots and cast iron soil pipes or in similar situations this difficulty is overcome readily.

While the development of zinc as a building material has been recent, it has also been rapid. In addition to gutters and down spouts, which are perhaps the most obvious applications and which have received particular attention from the New Jersey Zinc Company, a large amount of attention has been given to the design of exterior coverings for buildings from the roof to the ground line which primarily take the form of corrugated sheets. Another development of wide application is one which has received the particular attention of the Illinois Zinc Company, namely, the zinc shingles. These are of an interlocking design not unlike that of interlocking roofing tile, but with the advantage that they are nailed to the roof board like wooden shingles. These shingles have the further advantage that they are light and require no stronger roof construction than the wooden shingles and once in place will last indefinitely.

Roadmasters' Association

With the clearing of the atmosphere following the termination of the shopmen's strike, the indications are that the attendance at the convention at the Hotel Statler, Cleveland, on November 21-23 will equal or exceed that of previous years. The program will be as printed in the August issue, page 289. The outlook for the exhibit of the Track Supply Association is equally encouraging.

American Wood Preservers' Association

The program for the nineteenth annual meeting, which will be held in New Orleans, La., on January 23-25 inclusive, is rapidly nearing completion. It is expected that all of the reports of committees will be completed and in the hands of the secretary by November 1. The National Association of Railroad Tie Producers will hold its annual convention in the same city on January 26 and 27. It is anticipated that a special train will be provided for those members of these two associations living north and east of Chicago and St. Louis.

Maintenance of Way Club of Chicago

The sixth regular meeting of the Maintenance of Way Club was held at the Auditorium Hotel, Chicago, on October 11, the speaker of the evening being F. W. Hillman, who gave a talk on track walking which was followed by a lively discussion. Another feature of the meeting was the election of officers for the ensuing year with the following results: President, J. J. Navin, supervisor, Pennsylvania, Chicago; first vice-president, F. W. Hillman, division engineer, Chicago & North Western, Chicago; second vice-president, T. Thompson, roadmaster, Atchison, Topeka & Santa Fe, Joliet, Ill.; secretary-treasurer, W. S. Lacher, managing editor, *Railway Maintenance Engineer*, Chicago; members of the executive committee, C. T. Kimbrough, roadmaster, Indiana Harbor Belt, Chicago; D. J. Higgins, American Valve & Meter Company, Chicago, and William Hogan, supervisor, Baltimore & Ohio Chicago Terminal, Chicago.

American Railway Engineering Association

The Board of Direction has authorized the assignment of a committee on "Co-operative Relations With Universities" whose function will be to establish a closer contact between the association and those universities which are training engineering students for railway service. Prior to the organization of this committee, the secretary of the association has entered into correspondence with approximately 105 universities and colleges among whom this action of the association is favored.

Metropolitan Track Supervisors' Club

A talk by R. S. Parsons, vice-president of the Erie, on the importance of the track foreman in the efficient operation of a railroad was one of the main features of the meeting of the Metropolitan Track Supervisors' Club on October 14. G. W. Morrow presented a continuation of a paper on the cost of laying rail, which appears elsewhere in this issue. A short paper was also read by N. A. Schutz, supervisor of track, New York, New Haven & Hartford, on the construction and cost of bitumen bound highway crossings.

The Material Market

A GENERAL survey of the material market indicates that prices have reached the curve which rounds off the summit of the advance, that there is a lessening demand for materials and that we can expect a much more nearly normal market than the one that prevailed during the season of strikes through which we have just passed. In the case of structural steel, there is a perceptible softening of prices, the peak having occurred about the first of October. In the market for track materials, prices are still on the upward trend owing, no doubt, to the large demand for these materials during the time that the railroads are arranging for the necessary requirements of track fastenings to go with the large rail orders recently placed. It is estimated that 20,000 tons of track materials, other than rails, have been purchased in Chicago during the present season. Since the last writing the price of angle bars has been fixed at 2.75 cents, an advance of 0.35 cents over the price which prevailed when rails were quoted at $40.

Price Per 100 Pounds

	September 20		October 20	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	$2.75	$2.75 to $3.00	$2.75 to $2.85	$2.85 to $3.00
Track bolts	$3.75 to 4.00	3.75 to 4.00	4.50	3.85 to 4.00
Angle bars	....	....	2.75	2.75
Tie plates, steel	2.25	2.15 to 2.25	2.35	2.35
Tie plates, iron	....	2.15 to 2.25	....	2.50
Plain wire	2.35 to 2.50	2.69 to 2.84	2.45	2.79
Wire nails	2.60 to 2.75	2.94 to 3.09	2.70	3.04
Barbed wire, gal.	3.15 to 3.40	3.49 to 3.74	3.35	3.69
C. I. pipe, 6 in. or larger, per ton	....	48.20	....	51.50
Plates	2.00 to 2.25	2.10 to 2.34	2.00 to 2.25	2.10 to 2.30
Shapes	2.00 to 2.25	2.10 to 2.34	2.00 to 2.25	2.10 to 2.25
Bars	2.00 to 2.25	2.25 to 2.50	2.00 to 2.15	2.00 to 2.10
Open hearth rail per gross ton f. o. b. mill				$43.00

The prices of scrap shown in the table below indicate an increase in moderate amount over those quoted last month, but here also it must be understood that the advance is one that took place early in the month.

	Prices Per Gross Ton at Chicago	
	September	October
Relaying rails	$27.50 to $32.50	$27.50 to $32.00
Rerolling rails	19.50 to 20.00	20.50 to 21.00
Rails less than 3 ft. long	21.50 to 22.00	22.00 to 22.50
Frogs and switches cut apart	18.50 to 19.00	18.50 to 19.00
	Net Per Ton	
No. 1 railroad wrought	18.00 to 18.50	17.50 to 18.25
Steel angle bars	18.50 to 19.00	18.50 to 19.00

Prices in the lumber market also appear to have almost reached the summit. Conditions in the lumber market are far from normal on account of the exteme shortage of cars. As a consequence the production of lumber is considerably in excess of the shipments. However, there has also been a considerable reduction in the orders for lumber so that shipments and orders have maintained a reasonable balance.

Southern Mill Prices		
Flooring, 1x4, B and B, flat	$49.95	$50.90
Boards, 1x8, 14 and 16, No. 1	....	36.20
Dimension, 2x4, 16, No. 1	29.70	30.70
Dimension, 2x10, 16, No. 1, common	32.15	30.65
Timbers, 4x4 to 8x8, No. 1	25.15	27.00
Timbers, 3x12 to 12x12, No. 1	33.50	32.10
Douglas Fir Mill Prices		
Flooring, 1x4, No. 2, clear, flat	41.00	41.00
Boards, 1x6, 6 to 20, No. 1, common	14.00	14.00
Dimension, 2x4, 16, No. 1, common	20.50	20.50
Dimension, 2x10, 16, No. 1, common	21.50	21.50
Timbers, 6x6 to 8x8, No. 1, common	17.00	17.00
Timbers, 10x10 to 12x12, rough	18.00	20.00

Prices for Portland cement appear to be very steady. The recent card of prices issued by the Universal Portland Cement Company indicates only nominal changes from the table of prices issued a month earlier.

Chicago	$2.20	Duluth	$2.14
Cincinnati	2.51	Milwaukee	2.37
Davenport	2.43	Minneapolis	2.39
Detroit	2.48	Pittsburgh	2.24

General News

The number of licensed motor vehicles operating on the highways increased from 4,983,340 in 1917 to 10,608,128 on July 1, 1922, or more than 200 per cent.

S. W. Stratton, for 21 years director of the U. S. Bureau of Standards at Washington, D. C., has resigned to become president of the Massachusetts Institute of Technology, Boston, Mass.

The Mexican National Railways will be returned to their owners not later than November 15, according to an announcement reported to have been made by the Mexican treasury department.

Yellowstone National Park was visited by a total of 98,223 travelers this year as compared with 81,656 in 1921. Of this number, 33,588 persons traveled by railroad to the park's entrances.

The Bolivian Government is calling for tenders for the construction of a railway from Cochabamba to Santa Cruz de la Sierra, which will be 388 miles long, with a 37-mile branch line, and will cost from $40,000,000 to $50,000,000. The line will be meter gage with a maximum gradient of three per cent.

A plea has been made in the Circuit Court at Springfield, Ill., for the abandonment of the Chicago, Peoria & St. Louis, a line of 245 miles, extending from Peoria, Ill., to St. Louis, with branch lines from Havana, Ill., to Jacksonville and from Alton to Grafton. This road has been in the hands of receivers since 1914.

Reports of the Interstate Commerce Commission show the net operating income of Class I railroads in August to represent a return at an annual rate of only 2.65 per cent of their tentative valuation as compared with 4.4 per cent in July of this year and 4.04 per cent in August of last year. This return is the lowest since May, 1921, and is $61,689,500 less than the income necessary to give a return of 5¾ per cent on the valuation as allowed by the Interstate Commerce Commission. Forty-nine roads had operating deficits in August.

An investigation made in St. Louis over a 48-hour period to determine the degree of precaution taken by pedestrians and vehicle drivers at railway crossings showed that of 1,216 pedestrians, only one stopped and looked in both directions before proceeding over the crossing, that two persons looked in both directions but did not stop, that nine per cent looked in one direction only, and that 88 per cent did not stop or look to right or left. The investigation also showed that 91 per cent of the drivers of 2,931 automobiles failed to stop or look in either direction.

Nearly 6,000,000 cross ties were given preservative treatment preparatory to being placed in tracks of the Pennsylvania Railroad last year, according to a report of John Foley, forester. Of this number, more than two million were treated at the Pennsylvania's own plants at Greenwich Point, Philadelphia and Mount Union. While the initial cost was increased approximately 50 cents per tie, the report states that the extension of life given to the ties by the treatment results in practically a 25 per cent reduction in the annual cost of renewals.

There is now in service on the Canadian National a self-propelled passenger car which derives its power from steam rather than from gasoline. In appearance the car resembles the usual steam railroad passenger or interurban electric car. The body is of steel construction and the car is equipped with standard couplings. The power plant in the car embodies the principles used in the Stanley steam automobile and is built under the same patents. The car attains speeds of 45 and 55 miles per hour and at present prices is operated at a cost of about four cents a mile for fuel.

In a report presented before the recent meeting of the Railway Fire Protection Association in Washington, D. C., it was shown that on about 80 per cent of all Class I railroads of the country which made returns, 7,963 fires occurred in 1921. This is only 12 less than in 1920 and represents a total loss of $7,589,611. According to the report, losses due to fires on adjacent property are on the increase, indicating the need of keeping in closer touch with neighbors. It was further shown that losses due to smoking and from matches are also on the increase, the total of railroad losses arising from this source in the last three years amounting to $763,000.

The Post Office Department recently issued statistics showing that during the period of the railroad strike 1,269 mail trains were annulled by the railroads, representing a mileage of 112,540. Emergency measures, such as transferring mail pouches to other trains, re-routing mail and substituting automobile trucks for the railroads, were adopted so that there was no serious congestion of the mails at any point for any length of time. Postmaster General Work had planned for the mobilization of the Army and Navy air service to carry the mails and had also inaugurated a complete survey of the motor vehicles, both publicly and privately owned, that might be available to secure the safe and complete delivery of mails in case of a complete breakdown of railroad service.

Reports of the Car Service Division of the American Railroad Association show 968,169 cars of revenue freight to have been loaded during the first week of October. This represents an increase of 68,488 cars over the loading in the corresponding week in 1921, although it is less than the peak loading in 1920 by 43,487 cars. This figure also represents a slight decrease from the loading in the last week of September, when loadings reached a figure within three per cent of the highest point in railway history. The decrease is partly explained by a heavier loading of all cars in service arising from the car shortage. A report shows further that 32,929 fewer freight cars were in need of repairs on October 1 than on July 1, when the strike of railway shopmen began, and that the percentage of cars needing repairs at that time had been reduced from a figure of 15.8 per cent for last year to 12.8 per cent.

On October 10 the Chicago, Rock Island & Pacific celebrated the seventieth anniversary of its founding. Preparatory to the celebration a 250-page anniversary number of the Rock Island Magazine was issued, recounting in story form from the angle of various authors, the historical events making up the history of the road, and on the day set, which was the anniversary of the day upon which the first train ran from Chicago to Joliet, Ill., functions were held at various points on the system. Among the principal events was the running of a special train from Chicago to Joliet, this train being in charge of Charles Hayden, chairman of the Board of Directors, and of five employees whose aggregate service on the road equalled 200 years, and carrying among its passengers a woman who rode on the first train. At Joliet the party, including a great many of the veterans, proceeded to the court house lawn, where a monument was unveiled in honor of Samuel B. Reed, a civil engineer who surveyed the route between Chicago and Joliet. The celebration received a great deal of attention throughout the country tributary to the Rock Island.

Personal Mention

General

J. A. Nichols, assistant engineer on the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Galion, O., has been appointed assistant trainmaster, with headquarters at Terre Haute, Ind.

W. A. Guild, engineer of the Eastern district of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan., has been promoted to assistant superintendent, with headquarters at Marceline, Mo.

Sir Henry W. Thornton, general manager of the Great Eastern Railway in England, and an American engineer by education and early training, has been elected chairman of the board and general manager of the Canadian National System. Mr. Thornton was born on November 6, 1871, at Logansport, Ind., and was graduated from the University of Pennsylvania in 1894 as a civil engineer. Immediately thereafter he entered railway service as a draftsman on the Pennsylvania Lines West of Pittsburgh, since which he served successively as assistant engineer on the construction of the Cleveland & Marietta; topographer attached to the chief engineer's office of the Southwest system of the Pennsylvania Lines; assistant in engineer corps the Pittsburgh division; assistant engineer in field work attached to the chief engineer's office of the Southwest system; yard supervisor at Columbus, O.; assistant engineer of the Cincinnati division and assistant engineer assigned to special work until November, 1899, when he became engineer maintenance of way of the Erie and Ashtabula division. In March, 1901, he was promoted to superintendent of the Marietta division and in May, 1902, became superintendent on the Cleveland, Akron & Columbus; on December 23, 1903, he was transferred to the Erie and Ashtabula divisions and on February 1, 1911, he was promoted to assistant general superintendent of the Long Island (a subsidiary of the Pennsylvania), which position he held until November 14, 1911, when he was promoted to general superintendent. In April, 1914, he was appointed general manager of the Great Eastern Railway in England. During the World War he served as a member of the executive committee of general managers of the various British railways and in 1916 was appointed director of inland water communication, with functions extending to France, Egypt and Mesopotamia. In 1917 he was sent to Paris as assistant director-general of railways, and became further identified with military operations, holding the rank of colonel and later brigadier general. He finally had charge of army transportation on the continent with the rank of major general.

Sir Henry W. Thornton

Engineering

F. J. Biship has been appointed assistant engineer on the Ann Arbor, with headquarters at Owosso, Mich., succeeding **S. E. Emmons,** resigned.

F. A. Presler has been promoted to assistant engineer on the Indianapolis Terminal division of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Indianapolis, Ind., succeeding **H. J. King,** who has been transferred to Galion, O., in place of **J. A. Nichols,** who has been appointed assistant trainmaster, with headquarters at Terre Haute, Ind.

L. P. O. Exley, office engineer of the Gulf, Mobile & Northern, at Mobile, Ala., has been promoted to assistant chief engineer, with the same headquarters.

M. C. Blanchard, superintendent of the Illinois division of the Atchison, Topeka & Santa Fe, with headquarters at Chillicothe, Ill., has been promoted to chief engineer of the Western lines, with headquarters at Amarillo, Tex., succeeding **F. M. Bisbee,** retired. **W. C. Baisinger,** roadmaster at Ottawa Junction, Kan., has been promoted to engineer of the Eastern district, with headquarters at Topeka, Kan., succeeding **W. A. Guild.**

J. H. Baker, recently promoted to assistant engineer of valuation of the Southern Pacific, with headquarters at Los Angeles, Cal., was born April 30, 1882, in New York City. He entered railway service in April, 1905, as a chainman on the Los Angeles & Salt Lake and until November, 1905, was successively rodman and levelman. From November, 1905, to November, 1907, he was engaged in subdivision work at Los Angeles and levelman and transitman on location surveys. In February, 1907, he entered the service of the Western Pacific as a transitman and from February, 1908, to December, 1908, he was in charge of engineering work at Townsite Bay Point, Cal. In January, 1909, he entered the employ of the Southern Pacific of Mexico as an instrumentman and remained with this road until March, 1910, when he was made engineer in charge of an irrigation project, which position he held until November, 1910, when he entered the valuation department of the Southern Pacific in which work he has been engaged until his recent promotion.

H. A. Cassil, whose promotion to chief engineer of the Pere Marquette, with headquarters at Detroit, Mich., was reported in the October issue, was born at Mt. Vernon, O., and entered railway service on January 1, 1898, with the Cleveland, Akron & Columbia (now a part of the Pennsylvania). He entered the employ of the Pere Marquette in 1901 and held several positions on this road, including that of division engineer of the Detroit-Canadian division until 1906, when he entered the employ of the Canadian White Construction Company of Montreal, Que. Two years later he re-entered the maintenance of way department of the Cincinnati, Hamilton & Dayton. Following the absorption of this company by the Baltimore & Ohio, he remained with the latter road in various capacities until the reorganization of the Pere Marquette in 1917, when he was appointed engineer maintenance of way, the position he held at the time of his recent promotion.

H. A. Cassil

A. J. Hammond, assistant chief engineer of the Chicago Union Station Company, whose resignation on September 30, to become associated with James O. Heyworth, engineer and contractor, Chicago, was reported in the October issue, is a graduate of Rose Polytechnic Institute and a post graduate of Massachusetts Institute of Technology. He was engaged in municipal engineering work in Indiana up to 1898, thereupon entering railway service as an assistant engineer on the Vandalia (Pennsylvania), with headquarters at Terre Haute, Ind. He engaged in private practice in 1901 and from 1909 to 1910 was consecutively chief engineer of the Southern Michigan and Northern Indiana Electric Railways; bridge engineer of St. Joseph county, Ind., and consulting engineer of hydroelectric plants at South Bend and Elkhart, Ind., and Paw Paw, Mich., until 1910, when he was appointed consulting engineer of the city of Chicago for the intake water tunnel at Seventy-third street. He became chief engineer of the Bureau of Public Efficiency of Chicago in 1911, and from 1912 to 1913 was engineer of bridges and harbors of

the city. In 1914 he became consulting engineer of the Chicago Union Station Company and in 1915 was promoted to assistant chief engineer in charge of the design and construction of the passenger terminal, which position he held until his resignation on September 30.

Track

E. Belch has been appointed roadmaster of the Gila district of the Southern Pacific, Pacific System, with headquarters at Gila, Ariz., succeeding **Thomas Brown**, deceased.

Henry McLaughlin, whose promotion to supervisor of track on the Canadian division of the Pere Marquette, with headquarters at St. Thomas, Ont., was noted in last month's issue, was born in Canada on December 6, 1867. He entered railway service in 1891 at a trackman on the Michigan Central and held this position until 1897, when he became a section foreman on the Pere Marquette, the position he held at the time of his recent promotion.

J. B. Clapp, district roadmaster on the Marcus division of the Great Northern, has been transferred to the Spokane division, with headquarters at Wenatchee, Wash., succeeding **S. Allen**, who has been transferred to the Cascade division, with headquarters at Burlington, Wash., in place of **S. Jensen**, assigned to other duties. **Andrew Solga**, district roadmaster, with headquarters at Berthold, N. D., has been transferred to Rugby, N. D., succeeding **A. F. Fiala**, who has been transferred to Berthold, N. D., in place of Mr. Solga.

A. S. Murray, assistant roadmaster on the Colorado & Southern, has been promoted to roadmaster, with headquarters at Cheyenne, Wyo., succeeding **W. T. Hollen**, resigned. Mr. Murray was born on August 25, 1876, at Colbourg, Ontario, Canada, and received his education at the Collegiate Institute at Cobourg. He entered railway service in 1895 with the Atchison, Topeka & Santa Fe, and from that date to 1906 was successively brakeman and conductor. He entered the service of the Colorado & Southern in June, 1906, as extra gang timekeeper, since which he has been consecutively to the time of his recent promotion, material yard foreman, assistant foreman extra gang, foreman extra gang and assistant roadmaster.

C. W. Jenkins, assistant supervisor of track on the Pittsburgh division of the Pennsylvania Railroad, has been promoted to supervisor of track, with headquarters at Akron, Ohio, succeeding **C. E. Adams**, transferred to the Buffalo division, with headquarters at East Aurora, N. Y., succeeding **G. H. Doxrud**, transferred to Olean, N. Y., succeeding **J. D. Archibald**, transferred to sub-division No. 13 on the Pittsburgh division. **F. H. Rothe**, assistant supervisor of track sub-division No. 13 on the Pittsburgh division, has been promoted to supervisor of track sub-division No. 13½. **C. W. Shallenberger**, assistant supervisor of track on the Conemaugh division, has been transferred to the Pittsburgh division, succeeding Mr. Rothe. **H. R. Rockenbach**, assistant supervisor of track on the Buffalo division, has been transferred to the Pittsburgh division, succeeding Mr. Jenkins.

Charles Fowler, section foreman on the Atlantic Coast Line, with headquarters at Rocky Mount, N. C., has been promoted to roadmaster, succeeding **C. B. Reddick**, deceased. Mr. Fowler was born at Florence, S. C., on June 9, 1882, and entered railway service on October 1, 1898, as a section laborer on the Atlantic Coast Line near Charleston, S. C. On May 1, 1899, he was appointed an apprentice on an extra gang and on July 10, 1900, was promoted to section foreman at the Charleston yard, which position he held until December 1, 1900, when he was transferred to Mount Holly, S. C. From May 1, 1907, to June 1, 1911, he was section foreman at Salters, S. C., and on the latter date was transferred to extra gang foreman. Returning to Salters, S. C., as section foreman on October 1, 1914, he remained until May 29, 1916, when he was transferred to the Pinners Point yard at Portsmouth, Va. On March 6, 1922, Mr. Fowler was transferred to Rocky Mount, N. C., where he was serving as section foreman at the time of his recent promotion.

Henry H. Hoge, whose promotion to supervisor on the Louisville division of the Southwestern region of the Pennsylvania System, with headquarters at Columbus, Ind., was noted in last month's issue, was born on August 17, 1871, at Crothersville, Ind. He entered railway service on November 1, 1887, as a trackman on the Pittsburgh, Cincinnati, Chicago & St. Louis (now a part of the Pennsylvania), and from December 1, 1889, to January 1, 1893, served as foreman at New Albany, Ind. On the latter date he was promoted to yard foreman in the Louisville yard, which position he held until August 10, 1906, when he became a general foreman on the Chicago & Eastern Illinois at Haney, Ill. He returned to the Pittsburgh, Cincinnati, Chicago & St. Louis on December 1, 1906, as yard foreman in the Louisville yards, following which he served as acting assistant supervisor, a position he retained upon the acquisition of this road by the Pennsylvania, and in which he continued until his recent promotion.

G. W. Donnell, roadmaster of the Eugene district of the Portland division of the South Pacific, with headquarters at Eugene, Ore., has been transferred to the Marysville district of the Sacramento division, with headquarters at Marysville, Cal., succeeding **F. D. Dutton**, who has been transferred to the Truckee district, with headquarters at Truckee, Cal., in place of **S. R. Cupples**, who has been transferred to the San Jose district, with headquarters at San Jose, Cal., succeeding **M. Lahey**, retired. **B. W. Redick**, roadmaster on the El Paso lines, with headquarters at Marfa, Tex., has been transferred to the Eugene district of the Portland division, with headquarters at Eugene, Ore., succeeding Mr. Donnell. **J. B. Bickford** has been appointed roadmaster of the Suisun district, with headquarters at Suisun, Cal., in place of **B. Roland**, who has been transferred to the Alameda district, with headquarters at Niles, Cal., succeeding **J. Clendening**, retired. **C. C. Clark**, roadmaster, with headquarters at Niland, Cal., has been transferred to the Montello district of the Salt Lake division, with headquarters at Montello, Nev., in place of **D. F. Mulkern.**

Bridge and Building

Peter Aagaard, president of the T. S. Leake Construction Company, Chicago, and formerly superintendent of buildings on the Illinois Central, has returned to that road as general building inspector, with headquarters at Chicago, effective October 15.

Obituary

Cecil A. Preston, valuation engineer of the Pennsylvania, died at Philadelphia on October 9. Mr. Preston was born in Philadelphia in 1852 and was graduated from the Polytechnic College of Philadelphia in 1872 as a civil engineer. Immediately thereafter he entered railroad construction work, becoming an employee of the Pennsylvania in 1879. His first service with this company was in connection with surveys for new lines in which he was engaged until March 1, 1880, when he was appointed assistant supervisor of the Baltimore section of the Northern Central. He left for Mexico a few months later, where he was engaged as principal assistant engineer of the Mexican National Construction Company, until 1882 when he returned to the Pennsylvania (Northern Central) as assistant supervisor at York, Pa. He served in various engineering positions thereafter until July, 1900, when he was promoted to superintendent of the Elmira and Canandaigua divisions of the Northern Central, with headquarters at Elmira, New York. He was transferred to Williamsport in 1902 and to Altoona in the following year, where he remained until his appointment to valuation engineer in 1913.

C. A. Preston

Construction News

The Atchison, Topeka & Santa Fe has awarded a contract to Joseph E. Nelson & Sons for the construction of a lavatory building at San Bernardino, Cal., at an estimated cost of about $60,000.

This company will construct a 20,000-ton storage ice plant at Bakersfield, Cal., which will involve the purchase of some additional property and the rearranging of tracks to extend the yard facilities. The work is estimated to cost $466,837. This company is also contemplating rebuilding its icing plant at Needles, Cal.

The Atlantic Coast Line has awarded contracts for the laying of 47 miles of second main track as follows: Ashley River to Bennetts, S. C., three miles, to W. W. Boxley & Co., Roanoke, Va.; Ridgland, S. C., to Savannah River, 21 miles to E. W. Parket, Tampa, Fla.; Savannah River to Central Junction, Ga., 12 miles, to F. M. Jones, Savannah; Southover to Burroughs, Ga., seven miles, to Williams Bros. Construction Company, Roanoke, Va.; Doctortown to Jesup, Ga., four miles, to the C. G. Kershaw Contracting Company, Birmingham, Ala.

The Canadian Pacific is preparing plans for improvements of its ferry docks at Victoria, B. C., to cost about $150,000.

This company has awarded a contract to A. E. Hamilton, Moose Jaw, Saskatchewan, for a 100-ton standard mechanical coaling plant at Secretan, Saskatchewan, and has awarded contracts to T. Jamieson & McKenzie, Ltd., Calgary, Alta., for the extension of 12 stalls of the locomotive house at Calgary, Alta.; to A. C. Creelman & Company, Calgary, Alta., for the building of stations, section houses, grain loading platforms, stockyards and water tanks and for the fencing on 50 miles of the branch from Lanigan, Sask., to Naicam; to the Hamilton Bridge Company, Hamilton, Ont., for the construction of two 90-ft. turntables, for installation at Brandon, Man., and at North Bend, B. C.

This road has awarded a contract to the Northern Construction Company, Winnipeg, for the completion of the grading on the extension from Cracknell, Man., to Inglis, a distance of 6.2 miles. The company has also awarded a contract to W. A. Dutton, Winnipeg, for grading the final section of the Weyburn-Lethbridge line from Bain, Alberta, to Manyberries.

The Chicago, Burlington & Quincy, reported in the October issue as having closed bids for a one-story reclamation plant, 50 by 301 ft., at Eola, Ill., has awarded the contract to the Great Lakes Construction Company, Chicago. This company, reported in the October issue as having closed bids on September 25 for the construction of a passenger station, 24 by 100 ft., at Clarence, Mo., has awarded the contract to G. A. Johnson & Sons, Chicago.

The Chicago Great Western has awarded a contract to T. S. Leake & Company, Chicago, for the construction of a 20,000-ton capacity car icing plant 82 by 254-ft., at Oelwein, Iowa.

The Chicago, Rock Island & Pacific has awarded a contract to the International Filter Company, Chicago, for the construction of a water treating plant at Peoria, Ill., to cost approximately $25,000. The company has also awarded a contract to T. S. Leake & Company for the construction of a passenger station at Graham, Tex.

The Gulf, Colorado & Santa Fe will construct a two-story fireproof freight house 60 ft. by 301 ft. with structural steel frame, fireproofed with concrete, concrete floors, brick wall and steel doors and sash at Dallas, Tex., to cost $200,000.

The Illinois Central, which was reported in the October issue as contemplating improvements to its water facilities, has awarded contracts as follows: At Peosta, Iowa, to Miller Artesian Well Company, Chicago; at Kinmunday, Ill., and Pana, to Fairbanks, Morse & Co.; at Ramsey, to Joseph E. Nelson & Sons, Chicago; at Memphis, Tenn., and Champaign, Ill., to Layne & Bowler, Memphis.

A contract for the extension of passing tracks at Marissa, Ill., has been awarded to M. L. Windham, Centralia, Ill. A contract for passing tracks at Dowell, Ill., has been let to Blythe Brothers. and at Lenzberg, to Windt. The company will construct passing tracks at Marion, Ill., and Cambria with its own forces. A contract for additional storage tracks at Manchester, Iowa., has been let to P. E. Schugart, Freeport, Ill. This company has also awarded contract for the extension of passing tracks as follows: At Baton Rouge, La., $50,000, to Colley-Allelo; at Gardere, $12,000, and at Burnside, $18,000, to J. W. Garig; at Gramercy, La., $20,000, to Fred Gardner, and at Harriston, Miss., $30,000, to J. W. Noble. A passing track of 110 cars capacity will also be constructed at Ramsey, Ill., at a cost of approximately $19,000. This company will also construct an additional connection with the Wabash, Chester & Western at Tamaroa, Ill., at a cost of $15,0000. A contract has been let to F. Gardner for the construction of passing tracks at Reserve, La., to cost $46,000, and to W. L. Hicks for the construction of yard tracks and engine tracks at Natchez, Miss., to cost $12,000.

The Missouri, Kansas & Texas has awarded a contract to the Sumner Sollitt Company; San Antonio, Tex., for the extension of the freight station at Fort Worth, Tex.

The Missouri Pacific, reported in the October issue as receiving bids for the construction of a car repair shop at Kansas City, Mo., has awarded the contract to Jerome Moss & Co., Chicago. This company has awarded a contract to the List & Gifford Construction Company for the construction of a 2½-mile detour line between Corning, Ark., and Knobel, involving the construction of 228 panels of trestle and the placing of approximately 60,000 cu. yd. of earth embankment.

This company has also awarded contracts to the National Boiler Washing Company for the erection of new water treating plants at Ford, Ill., Knobel, Ark., Jefferson City, Mo., Waverly and Nevada, and for the remodeling of existing plants at Kansas City, Mo., Herington, Kan., Marquette, Concordia and Eads, Col., and Haswell, Union, Neb.

The New York, New Haven & Hartford has awarded a contract to Roberts and Schaefer Company, Chicago, for a 300-ton capacity, reinforced concrete, automatic electric locomotive coaling plant at South Worcester, Mass., and a 600-ton capacity, reinforced concrete, three-track "RandS" shallow pit automatic electric locomotive coaling plant at Boston, Mass.

The Pennsylvania has announced a program for extensive improvements to be made at Altoona, Pa., including the construction of two large locomotive repair shops and the electrification of heavy grades west of Altoona. The first of the improvements will be made at the Juniata shops and includes the building of a 340 ft. by 670 ft. machine shop to accommodate 49 locomotives. The contract for this work has been awarded to McClintic-Marshall Company. There will also be erected a three-story reinforced concrete storehouse, 60 ft. by 400 ft., including a material handling crane runway, 600 ft. long. This company is asking for bids on the work necessary to complete the east bound main track and siding, West Morrisville yard, which work will involve 15,000 cu. yd. excavation, and 1,600 cu. yd. cinder ballast.

The Union Pacific, reported in the October issue as receiving bids for the extension and repairing of its passenger station at Kearney, Neb., has awarded the contract to P. J. Sullivan, Denver, Col.

Equipment and Supplies

The Ann Arbor Railroad has ordered 3,000 tons of rails from the Midvale Steel & Ordnance Company.

The Atchison, Topeka & Santa Fe has ordered 64,000 tons of rails, divided as follows: 25,000 tons, Illinois Steel Company; 25,000 tons, Colorado Fuel & Iron Company; 11,000 tons, Inland Steel Company, and 3,000 tons, Bethlehem Steel Company.

The Baltimore & Ohio is inquiring for 7,000 tons of tie plates and 15,000 kegs of track spikes, and has placed orders for 52,000 tons of steel rails for delivery during 1923, as follows: Carnegie Steel Company, 23,000 tons; Illinois Steel Company, 7,000; (2,000 tons included for Baltimore & Ohio Chicago Terminal Railroad); Cambria Steel Company, 12,000, and Bethlehem Steel Company, 10,000.

The Chesapeake & Ohio has placed orders for 24,500 tons of rail for 1923 delivery as follows: Inland Steel Company, 7,500 tons; Illinois Steel Company, 7,500 tons; Carnegie Steel Company, 4,500 tons, and Bethlehem Steel Co., 5,000 tons.

The Chicago, Burlington & Quincy has ordered 15,000 tons of rails from the Illinois Steel Company, and is reported also to have ordered 15,000 tons from the Colorado Fuel and Iron Company and 4,000 tons from the Inland Steel Company.

The Chicago, Indianapolis & Louisville has placed an order with the Illinois Steel Company for 3,000 tons of steel rails.

The Chicago, Milwaukee & St. Paul is reported to have purchased 40,000 tons of steel rail from the Illinois Steel Company and 10,000 tons from the Inland Steel Company.

The Chicago, Rock Island & Pacific has ordered 35,000 tons of rails from the Illinois Steel Company and 5,000 tons from the Inland Steel Company.

The Delaware & Hudson has ordered 10,000 tons of 90-lb. rails from the Bethlehem Steel Company for 1923 delivery.

The Delaware, Lackawanna & Western has ordered 15,000 tons of rails from the Bethlehem Steel Company, including 101-lb. and 105-lb. sections.

The Erie has placed orders for 37,500 tons of 100-lb. rails.

The Great Northern has placed an order for 10,000 tons of steel rails with the Illinois Steel Company and 5,000 tons each with the Inland Steel Company and the Bethlehem Steel Company.

The Illinois Central has made reservations divided with various steel companies for 60,000 tons of rails.

The Lehigh Valley has ordered 20,000 tons of 136-lb. rails from the Bethlehem Steel Company.

The Missouri, Kansas & Texas has ordered 10,000 tons of steel rails from the Illinois Steel Company, and made an inquiry during the month for 3,000 tons of tie plates, 2,000 kegs of track bolts and 4,500 kegs of spikes.

The Missouri Pacific has ordered 15,000 tons of rails and issued an inquiry during the month for 3,000 tons of tie plates.

The New York, New Haven & Hartford has reserved space with the Bethlehem Steel Company for 25,000 tons of 107-lb. rails, for delivery in the early part of 1923.

The New York, Ontario & Western has ordered 4,000 tons of 90-lb. rails from the Bethlehem Steel Company.

The New York, Chicago & St. Louis has placed an order for 19,000 tons of rails, divided between Carnegie Steel Company, the Lackawanna Steel Company and the Inland Steel Company.

The Norfolk & Western issued an inquiry during the month for 17,000 kegs of track spikes and 12,000 kegs of track bolts.

The Pennsylvania Railroad has ordered 170,000 tons of rail for 1923 delivery.

The Pere Marquette has divided an order for 15,000 tons of rails equally between the Bethlehem Steel Company, the Illinois Steel Company and the Inland Steel Company.

The Philadelphia & Reading has placed orders for 25,000 tons of 100 and 130-lb. rails with the Bethlehem Steel Company, the Carnegie Steel Company and the Cambria Steel Company.

The San Antonio & Aransas Pass has issued an inquiry for 5,500 tons of rails.

The Southern Railway has ordered 40,000 tons of rails from the Tennessee Coal, Iron & Railroad Company. Most of the rail will be 100-lb. sections for delivery during the first six months of 1923.

The Southern Pacific has issued an inquiry for approximately 15,000 tons of tie plates.

The Toledo, St. Louis & Western has placed an order for 8,000 tons of rails with the Carnegie Steel Company.

The Union Pacific has issued an inquiry for 7,000 tons of tie plates, 10,000 kegs of track spikes and 8,000 kegs of track bolts, and has placed orders for 60,000 tons of rails, of which the Colorado Fuel & Iron Company received a contract for 20,000 tons and the Illinois Steel Company, 40,000 tons.

The Wabash has ordered 15,000 tons of rails.

Supply Trade News

F. N. Bard, president of the Barco Manufacturing Company, Chicago, has been elected president of the Argyle Railway Supply Company, with offices at 327 South La Salle street, Chicago.

Walter S. McKee has resigned as vice-president and director of the American Manganese Steel Company and in future will develop the business of the Inland Engineering Company, Chicago, of which he is president.

E. P. Sawhill has been placed in charge of the conveyor sales of the Brown Hoisting Machinery Company, Cleveland, Ohio. Mr. Sawhill has had nearly 30 years' engineering and selling experience on this type of equipment.

R. L. Wilson, formerly of the Mid-Continent Equipment & Machinery Company, St. Louis, Mo., has organized the Pan-American Equipment Company, New Orleans, La., to engage in the sale of general equipment including cars, locomotives and track accessories.

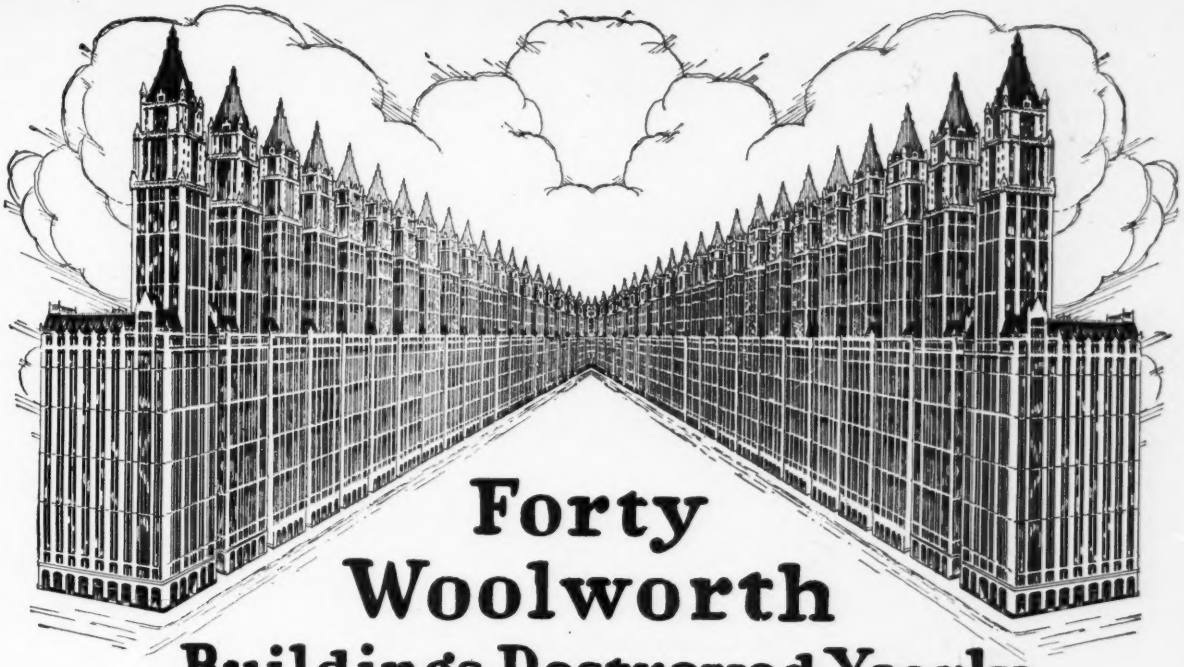
Herbert C. Follinger, manager of the Chicago office of the Chain Belt Company, Milwaukee, Wis., died of pneumonia at his home in Chicago, on September 27, at the age of 38. Mr. Follinger became associated with the Chain Belt Company in 1914 and in 1916 was appointed district manager for the Chicago territory.

C. R. Dodge, western sales manager of the Lakewood Engineering Company, has been appointed sales manager of the Northwest Engineering Company, Green Bay, Wis., with headquarters at Chicago. Prior to his connection with the Lakewood Engineering Company, Mr. Dodge, from 1910 to 1917, was in charge of the Milwaukee Concrete Mixer Company's business in the east, as well as operating his own organization, handling a general line of contractor's equipment under the name of C. R. Dodge & Company, with office in New York. In 1917, when the Lakewood Engineering Company took over the sale of the Milwaukee concrete mixers, Mr. Dodge was placed in charge of an office in Philadelphia, Pa., where he remained until 1918, when he became field sales manager of the Lakewood Engineering Company in charge of all district offices and agencies. In 1920, he was promoted to western sales manager of this company, the position he held at the time of his recent appointment.

C. R. Dodge

The Johns-Manville, Inc., New York City, has been appointed joint selling agents by the H. H. Robertson Company, Pittsburgh, Pa., and in future all asbestos protected metal roofing, siding accessories and ventilators will be manufactured and shipped from the plant of the H. H. Robertson Company at Ambridge near Pittsburgh. Hereafter, in the manufacture of asbestos protected metal products by H. H. Robertson Co., Johns-Manville asbestos saturated felts will be used.

The Atlas Steel Corporation, Dunkirk, N. Y., was organized on October 2, as the result of a merger between the Youngstown Electric Alloy Steel Company, Youngstown, Ohio, and the Atlas Crucible Steel Company, Dunkirk, N. Y. **Louis J. Campbell,** a former vice-president of the Youngstown Sheet & Tube Company, was elected chairman of the board of directors; **Arthur H. Hunter,** president, and **J. H. Roberts,** vice-president.



Forty Woolworth Buildings Destroyed Yearly

EXPERTS estimate that a million tons of steel are consumed by corrosion in the United States every year. This is roughly equal to one-third of the flush production of structural steel in this country, — sufficient for forty Woolworth Buildings yearly.

The preservation of steel is one of the big problems of the present-day engineer. Properly protected, steel would last forever.

It takes years to prove the quality of a metal protective pigment. Sublimed Blue Lead has passed the test. The famous Atlantic City tests of the American Society for Testing Materials proved it to be the best commercial pigment for the protection of steel from corrosion. Chemically it will inhibit rust, and physically it becomes incorporated in oil so that it produces a lasting film that gives additional protection to the iron by excluding air and moisture.

Sublimed Blue Lead in addition to its extraordinary durability possesses the advantage of easy brushing and spreading properties, which combined with its covering power make it a most satisfactory metal protective paint.

Picher
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What it is—What it does.

PICHER SUBLIMED BLUE LEAD is a "fume product"—made by subliming the lead ore, galena (lead sulphide) and collecting the fumes. The pigment thus produced is a slate gray powder, of impalpable fineness, which when mixed with pure linseed oil produces a paint of remarkable hiding power and exceptional brushing and spreading qualities, which will endure years of exposure in service, without cracking, checking or peeling. This pigment remains perfectly suspended in oil and will not harden in the container.

Low in first cost and of the highest efficiency in service, PICHER SUBLIMED BLUE LEAD will be found the best paint to use for all rust-proofing purposes.

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COMPARE

This Verona Rail Joint Spring does the work of two nut locks.

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Compare the mass of metal in the spring with the mass of metal in the nut locks.

Compare their strength.

Compare the evident distance thru which the spring can re-act with the utmost distance possible to the nut locks.

Then ask yourself these questions:

Which will hold the bolts tighter?

Which is better able to compensate for bolt stretch and wear?

Which means minimum maintenance cost and maximum safety?

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